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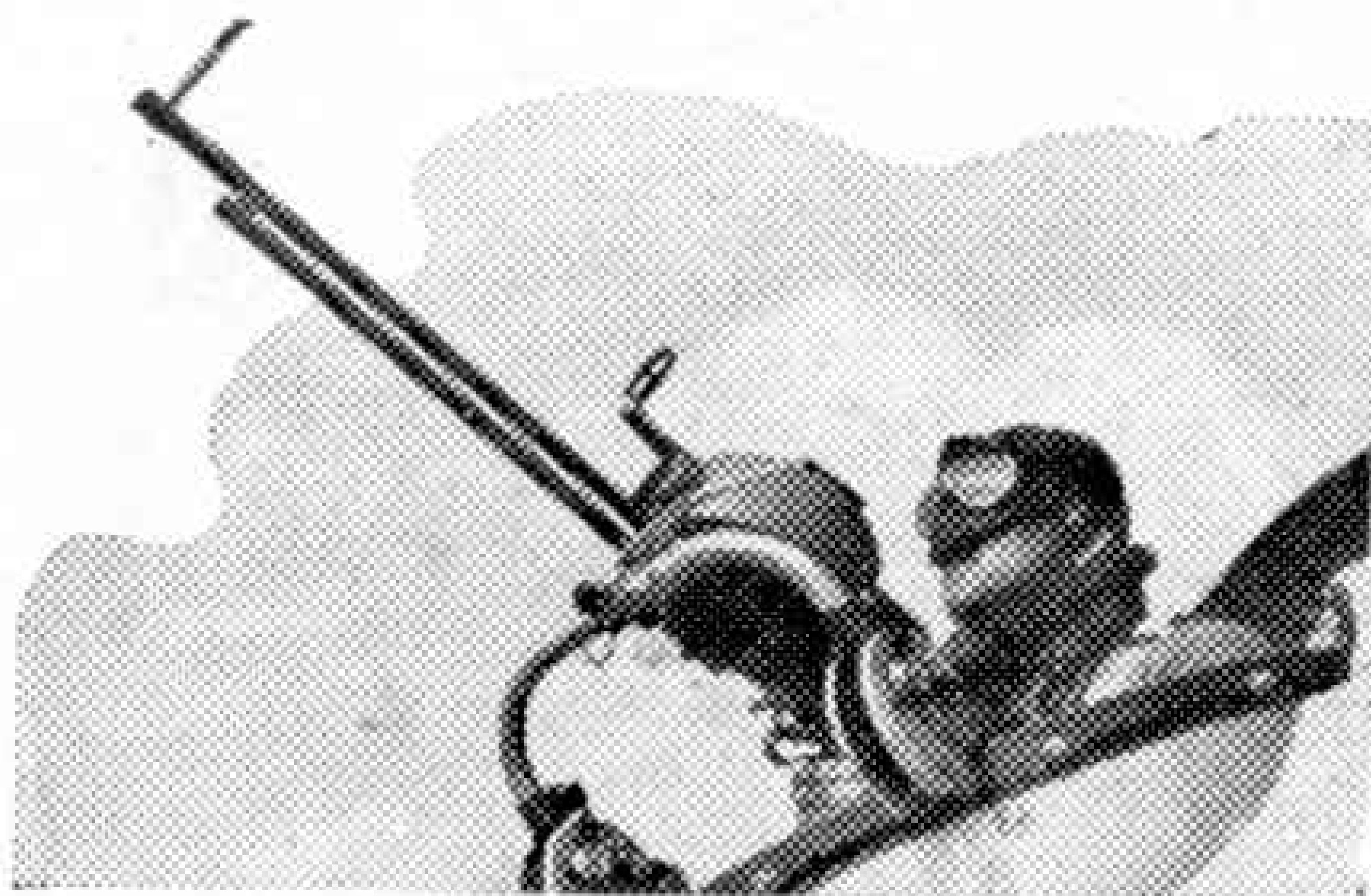
MECCANO

MAGAZINE



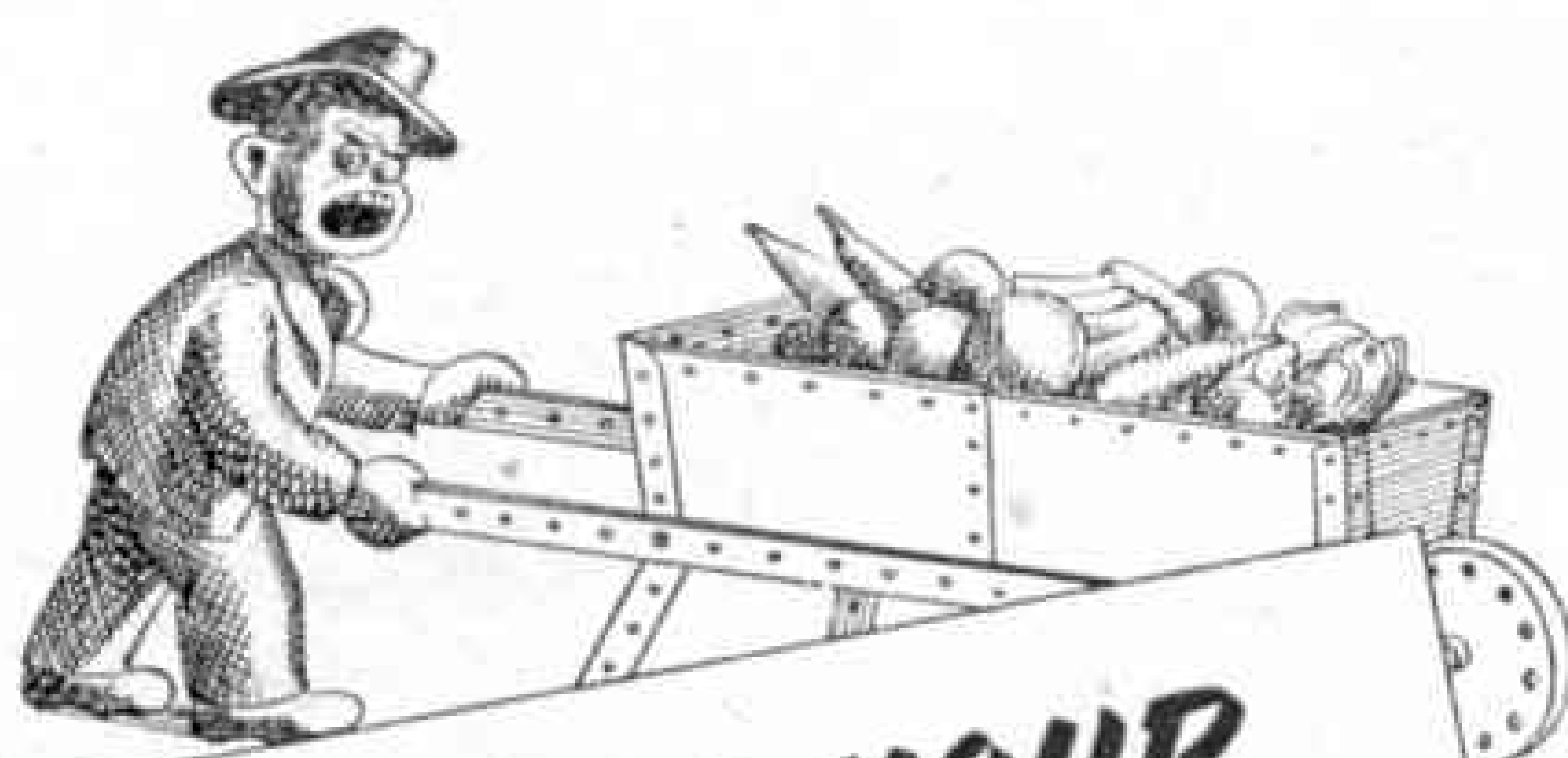
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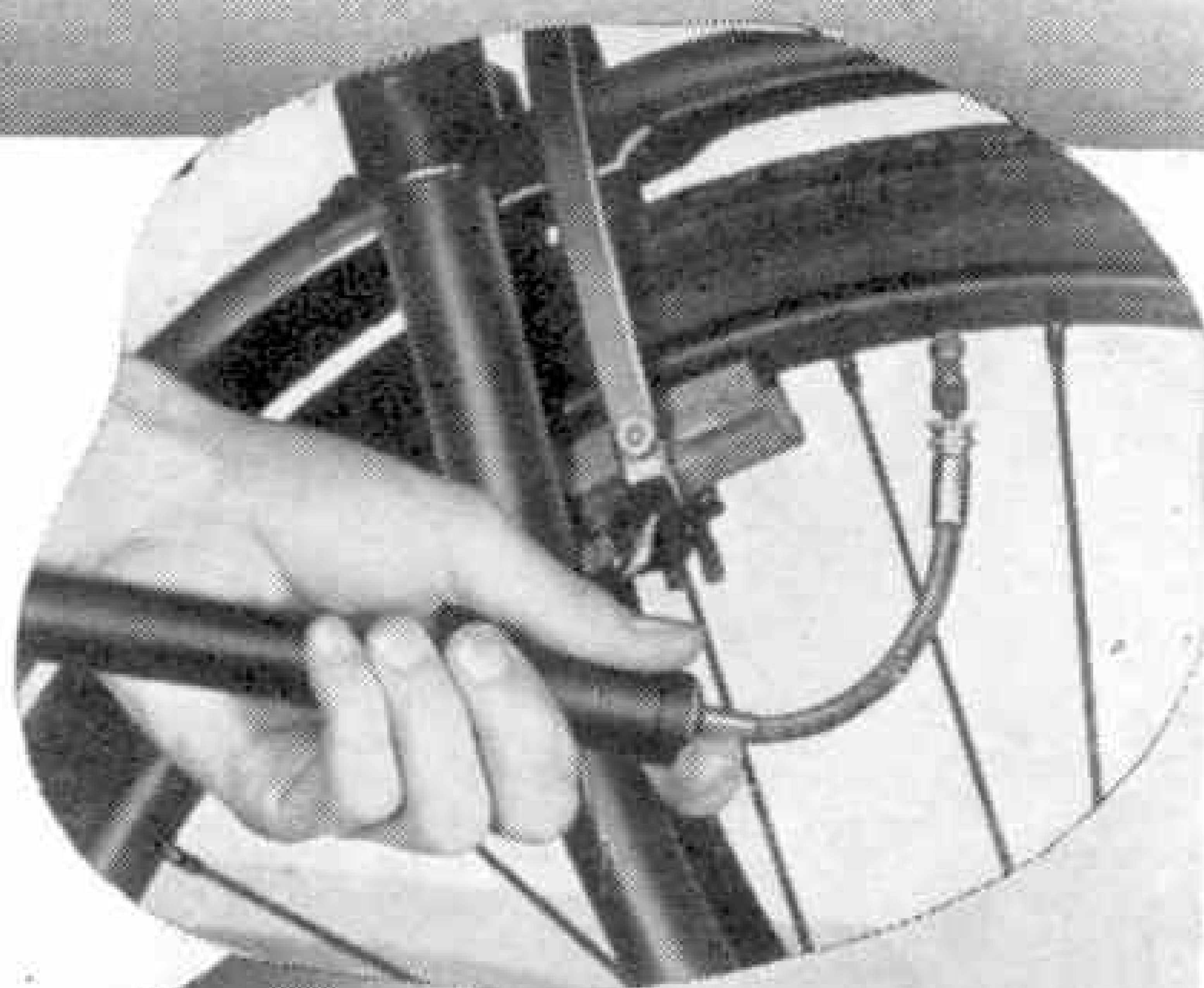
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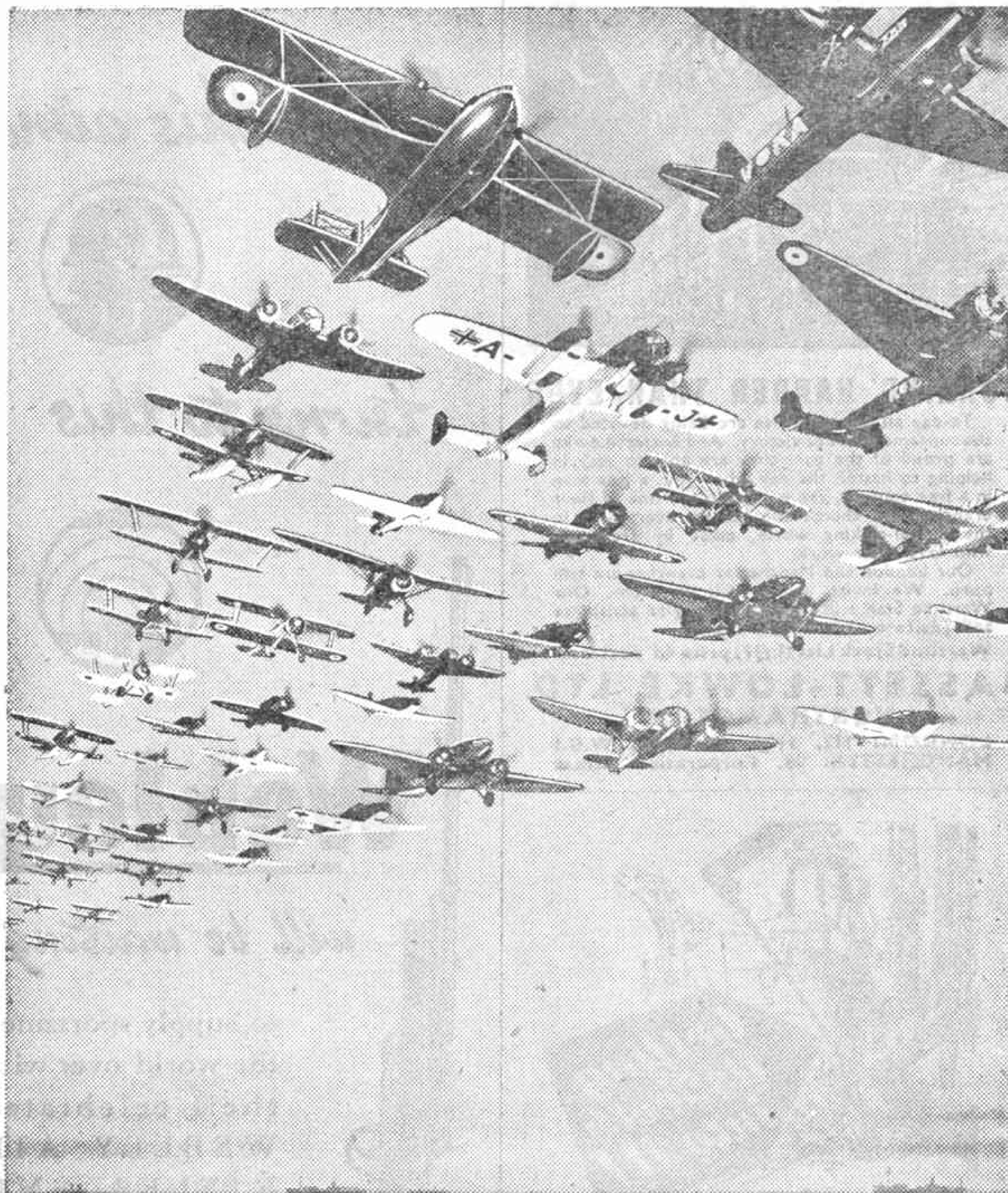
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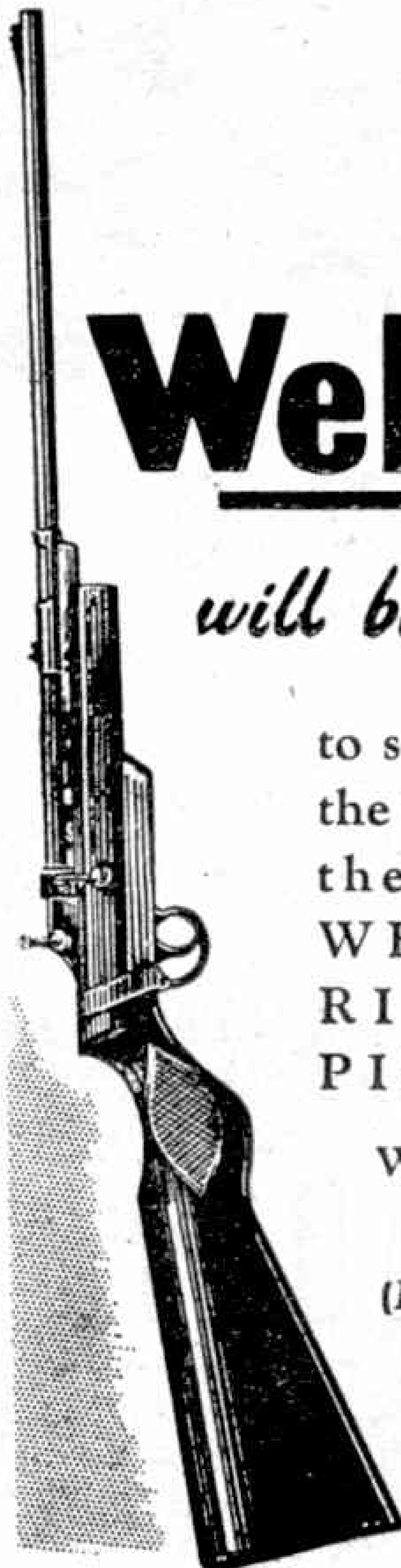


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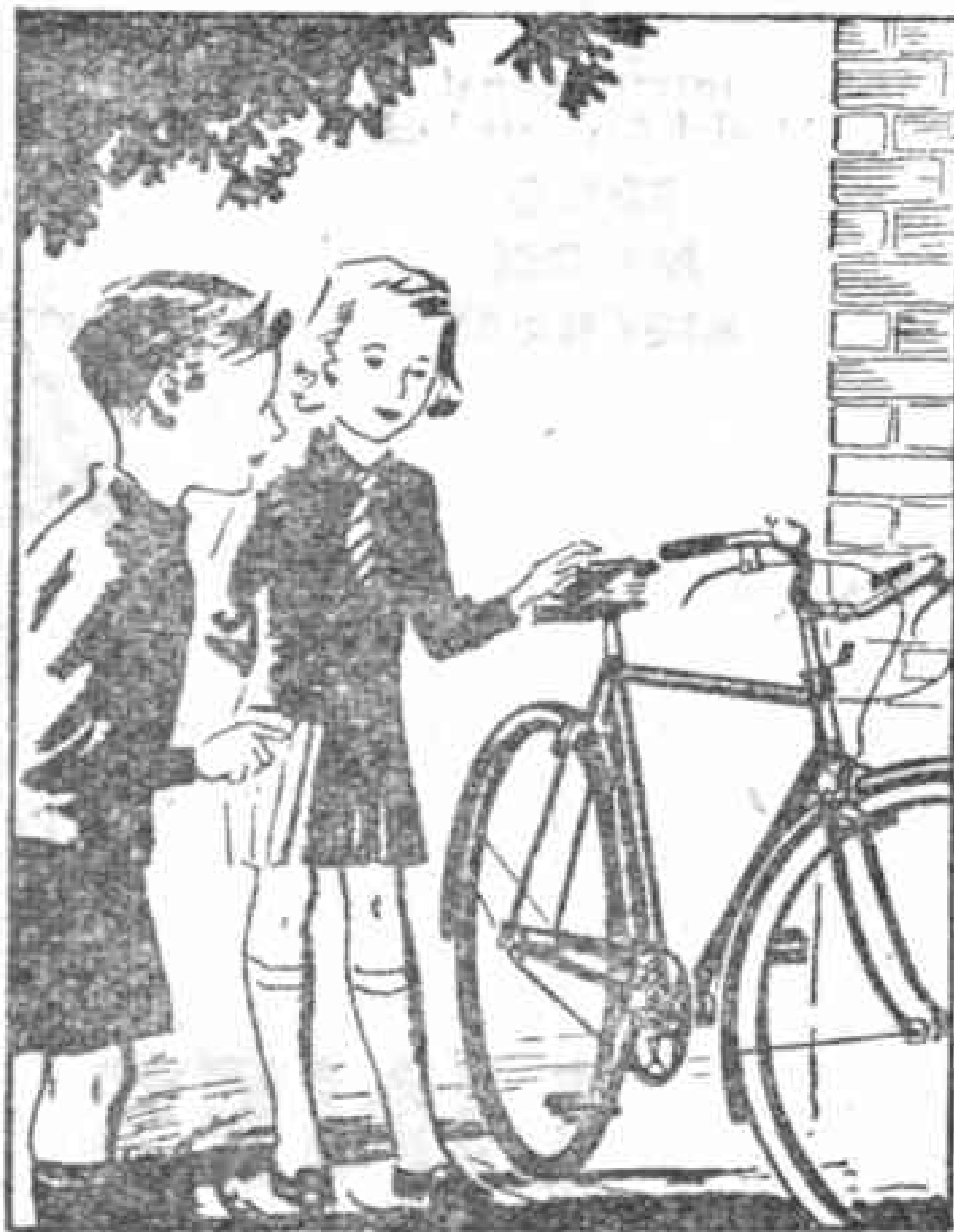
THANK YOU, BOYS & GIRLS!

Now that our story "The Spy-clists" has come to an end we at B.S.A. would like to say thank you—thank you to you all.

We have been quite overwhelmed by the interest you've taken in the B.S.A. Missing Word Competitions and by the large number of entries. We like to think that Michael and Monica are a boy and girl just after your own heart—observant, courageous, and unbeatable—on their B.S.A. cycles.

The winners have had their reward in hard cash, but we hope that you boys and girls who did not reach the goal will accept our friendship all the same.

We will see to it that no B.S.A. shall ever disappoint you—that we promise. At the moment, as you know, you have to be very patient to get your B.S.A. But that's a sacrifice that helps to win the war. And for after the war we are planning bright, new, light B.S.A. machines for every one of you. We've promised to do our best, but even you will be surprised to find just how good that "best" will be.



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MECCANO

MAGAZINE

Editorial Office:
Binns Road
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Vol. XXIX
No. 2
February 1944

With the Editor

This Stainless Steel Business

The letter on stainless steel from Mr. E. N. Simons published last month on this page has produced quite a crop of interesting comments from readers. I was greatly surprised to find from these letters that the old belief still lingers on—mainly, I gather, among elderly aunts—that stainless steel knives cannot be sharpened because this would remove their rust-resisting covering and so turn them into ordinary steel. These dear old ladies are quite convinced that stainless knives are just ordinary knives that have been dipped into some mysterious liquid that makes them rustless, and must not on any account be rubbed off!

I hope readers will promptly take in hand all such elderly relatives, and then perhaps the dreadfully blunt stainless table knives that still survive in private houses will disappear for ever.

A Tribute to the "M.M."

Last week there arrived from a Flying Officer in the R.A.F. a letter that interested me and my staff very greatly. We thought it would interest readers also, so here it is:

THE EDITOR,
"MECCANO MAGAZINE."

DEAR SIR,

Back in the Spring of 1928 I started to read odd copies of the "Meccano Magazine," and as a very youthful schoolboy was immediately impressed and fascinated by the many and varied articles that it contained. As soon as my father saw copies he placed a standing order with the local newsagent for it to be delivered indefinitely. I am afraid that I could not make the days go fast enough so that on the first of each month I would be able to read another issue of the "Meccano Magazine." I read each article very carefully, and seemed to absorb a fund of very valuable information on a great diversity of subjects.

Years went by and I left school. I worked in an office for four years until the outbreak of war, when I joined the R.A.F., and still I read the "M.M." Then, just two years ago, I was sent to the United States as a cadet, and to my astonishment I found

that I was no stranger in a strange land, as such items as the names of the railway companies were familiar, and many details I recalled as having read years earlier in your excellent publication. I was fortunate to be retained out there on flying duties with the U.S. Air Corps, and at the same time to be able to travel very extensively through most of the States. It was then that I realised how great had been the value of the many articles that I had read. I was able to visit such places as the Grand Canyon, Yosemite National Park, The Mariposa Grove of Big Trees, the Indian country, and places up and down the Mississippi, mainly on the strength of details that I had remembered from years before; and when it came to engineering achievements that I saw, such as Boulder Dam, the Holland Tunnel, the San Francisco bridges and others, I was frequently able to describe details of construction to local inhabitants!

It is in this respect that I am writing you. I wish to place on record my appreciation of the very high standard of the articles that you have so consistently maintained and incorporated in a magazine that is read by so many young fellows at the time of their lives when their minds are most receptive to detail. I know of no finer publication of its class, and would recommend it to all.

Wishing you continued success, and an early return to the large and thick issues of pre-war days.

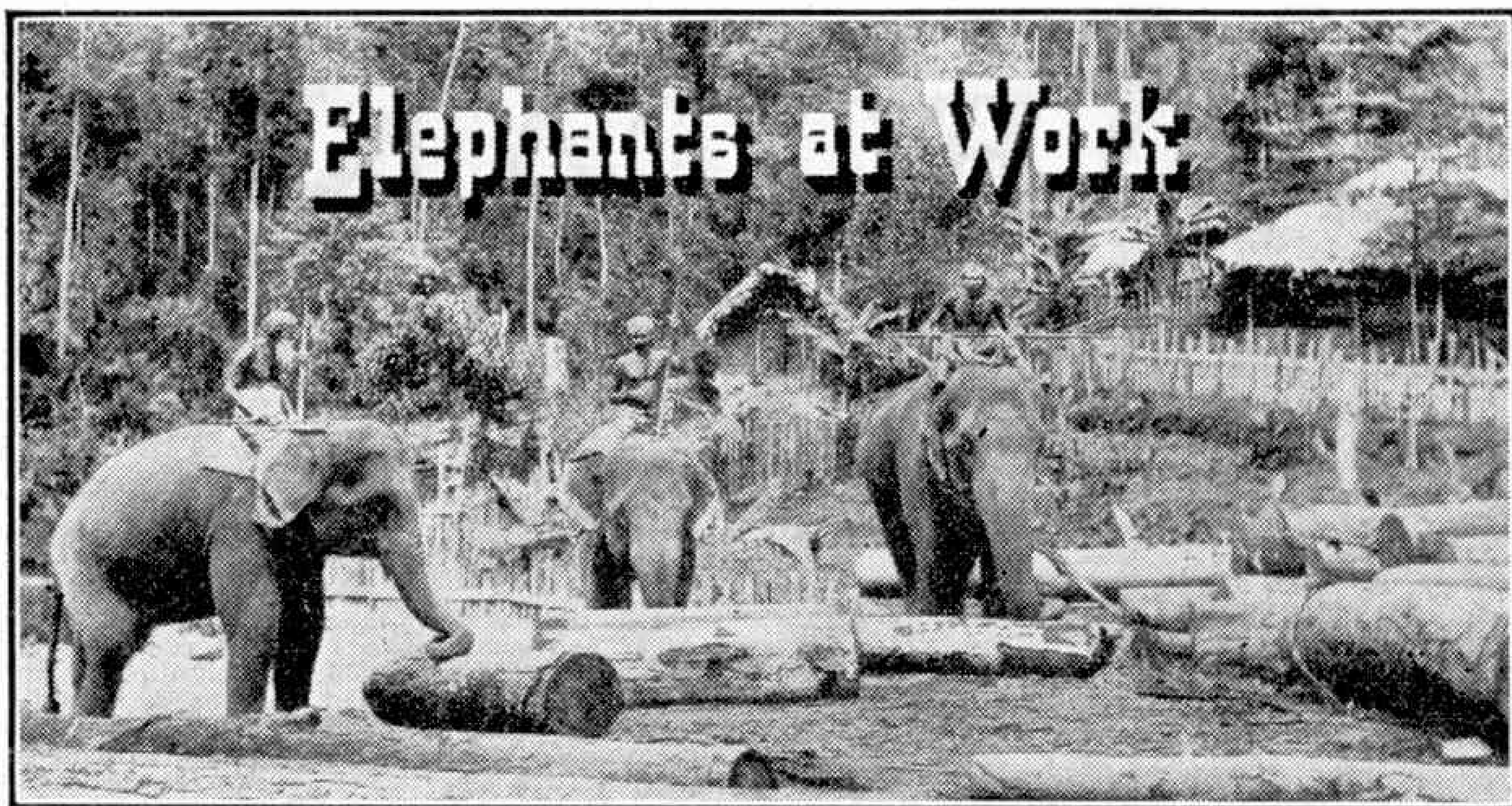
Yours faithfully,

F/O. R.A.F.

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By Harold J. Shepstone, F.R.G.S.

OF the various wild creatures that man has tamed and trained to toil for him, there is no more intelligent worker than the lordly elephant, the largest of all land animals.

The ancients knew the value of the elephant as a beast of burden, and made good use of him. We find the elephant mentioned several times in the Bible, and also at considerable length in the first and second book of Maccabees, where the use of these animals for war is described. The old Indian monarchs made use of the elephant in war, notably against the invasion of Alexander the Great and Tamerlane. We all know how Hannibal crossed the Alps with 37 fighting elephants and defeated the Romans at Ticinus.

In modern times, however, the elephant has never appeared in the fighting line. He has a wholesome dread of firearms, and by reason of his bulk and great strength this fear of fire would probably result in his doing more harm to his friends than to his foes. He would be liable to turn tail and bolt, trampling down men and horses as he rushed away. For this and other reasons he is only used for carrying tents and other impedimenta, hauling heavy guns, etc.

There were in 1938, the latest year for which official figures were available, 1,607 elephants in the services of the Indian Government, made up as follows:

Commissariat, Bengal and North India	...	1,016
Bombay	...	78
Madras and Burma	...	213
Forest, Frontier, Police, Railway, Telegraph and Public Works Departments in India and Burma	...	300
Total	...	1,607

The headquarters of the Indian elephant service is at Decca, in Bengal. Just outside of this city is an enormous peelkhana, or elephant depot, over a square mile in extent. It boasts of its hospital, warehouses and stores. All these buildings are close to the river, so that the elephants may have easy access to the water; this also ensures the carriage by boat of enormous quantities of green fodder. It is to this depot that newly-acquired animals are marched by a small army of men, and kept there to be drawn upon as required for Government and private service. Altogether some 17,000 men are employed in the elephant service of the Indian

Government. During recent years the service has been much improved, and it is now officered entirely by white men.

The elephant is a delicate creature, liable to sun-stroke and other ailments. In his 18 waking hours he will eat over 700 lb. of lush fodder. He throws aside a good deal; if you give a big working elephant 800 lb. of long-stalked dhall grass, he will probably waste 100 lb. of it. Sometimes a change of diet will be recommended by the Government veterinary surgeons and 750 lb. of dry sugar-cane will be substituted for the grass.

In Decca specially-trained British officers take charge of the vast elephant clearing house, and are in constant touch with all parts of the Empire, from the Himalayas to the extreme south. They regulate the transport and forwarding of the elephants by the special trains and fleets of steamers built for the purpose. Sometimes an order for 60 tuskers will be received from an important military centre like Lahore. Such animals are selected by experts. Each is required to possess high intelligence, a good temper, and much capacity for work. He is taught to salute with his trunk, to haul a big gun, and to do many tasks entirely unaided. The selected animals are entrained in specially-built freight cars—a highly troublesome business. Many attendants travel in these trains to calm their terrified charges. The vessels used belong to what is known as the elephant fleet. Some of these vessels will carry 300 tuskers with their trained attendants.

Every military post in India has its battery of working elephants, each capable of marching 40 miles a day with a load of half a ton. Each battery consists of six guns, and there are 12 elephants to each battery, two to each gun or howitzer. There is a jemadar, besides 12 mahouts and 12 grass-cutters to look after the elephants. Not only are these creatures used for hauling heavy guns and carrying stores, but also they are called to the aid of the gunners to remove guns that have become fixed in the mud. In this work they often display wonderful intelligence.

Before the treacherous Japanese gained control of Burma, it was a wonderful experience to visit the great timber yards of the Irrawaddy, where elephants were regularly employed. Here also they displayed no mean intelligence. They appeared to take orders from their masters like dock labourers,

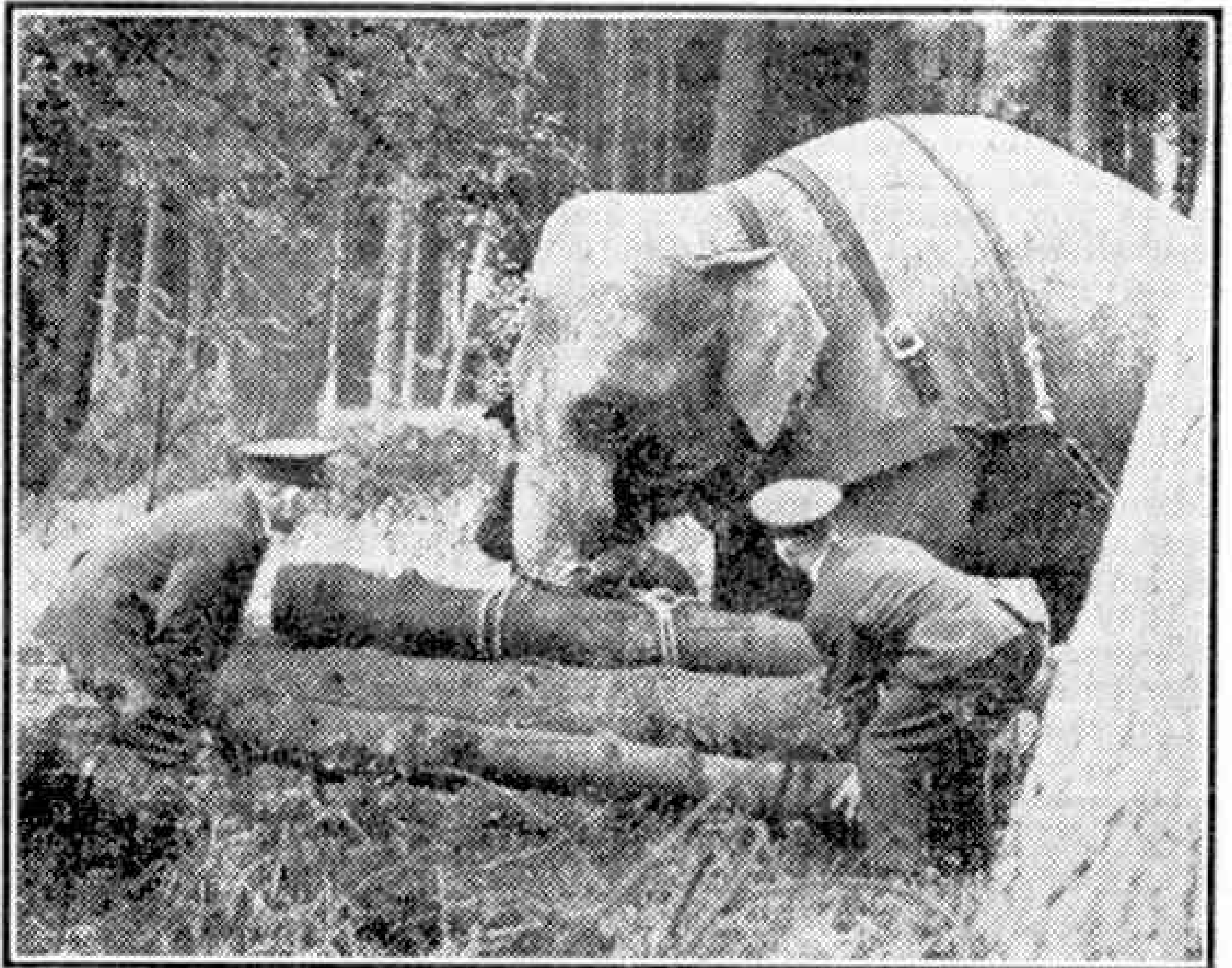
and, what is more, to faithfully execute them. Indeed, a visit to these yards at Rangoon was a wonderful sight. The din of the saw-mills, the perpetual loud buzzing of wheels, the fall of dropping planks, and the clanking of the drag-chains created a veritable pandemonium. Yet, in the midst of it all, elephants moved about fulfilling their allotted tasks, indifferent to the noise, unperturbed and silent.

A number might be seen engaged in dragging the logs to the mill to be sawn. They were harnessed with a broad breastband and heavy chains for this purpose. A native looped the chains round the logs, and the elephant at once conveyed them to the trolley, on which he deposited them. Others picked up with their trunks the sawn planks and carried them across the yard to be piled. A mahout sat on the neck of every elephant, and if the animal picked up too small a plank the mahout made his giant charge understand that two might go to that load. Then, grunting, the elephant would pick up the second plank with infinite delicacy of balance, turn, march over, and deposit them beside the pile. Even more fascinating was it to watch a jungle patriarch stack the timber. He would kneel down to a heavy log, twist his trunk around it, place it on top of the pile, and then calculate its position, and push and pull until it was square in its place. If a log was too heavy for one animal to tackle, a second was called into service. Then, both kneeling, each lifted his own end, as neatly and as deftly as trained workmen.

It was said of the elephants in these yards that they knew the time of day, and would on no account work "after hours." They began at 6 o'clock in the morning. At 11 o'clock left off for dinner, and began again at 3 o'clock, working till dusk. No matter how busy they might be at 11 o'clock, they

all dropped their work and quietly marched off to their stables. The overseers at the yards said that nothing would induce the elephants to do a stroke of work between these "off hours!"

We know that the elephants are still toiling under their temporary Japanese masters. It will not be



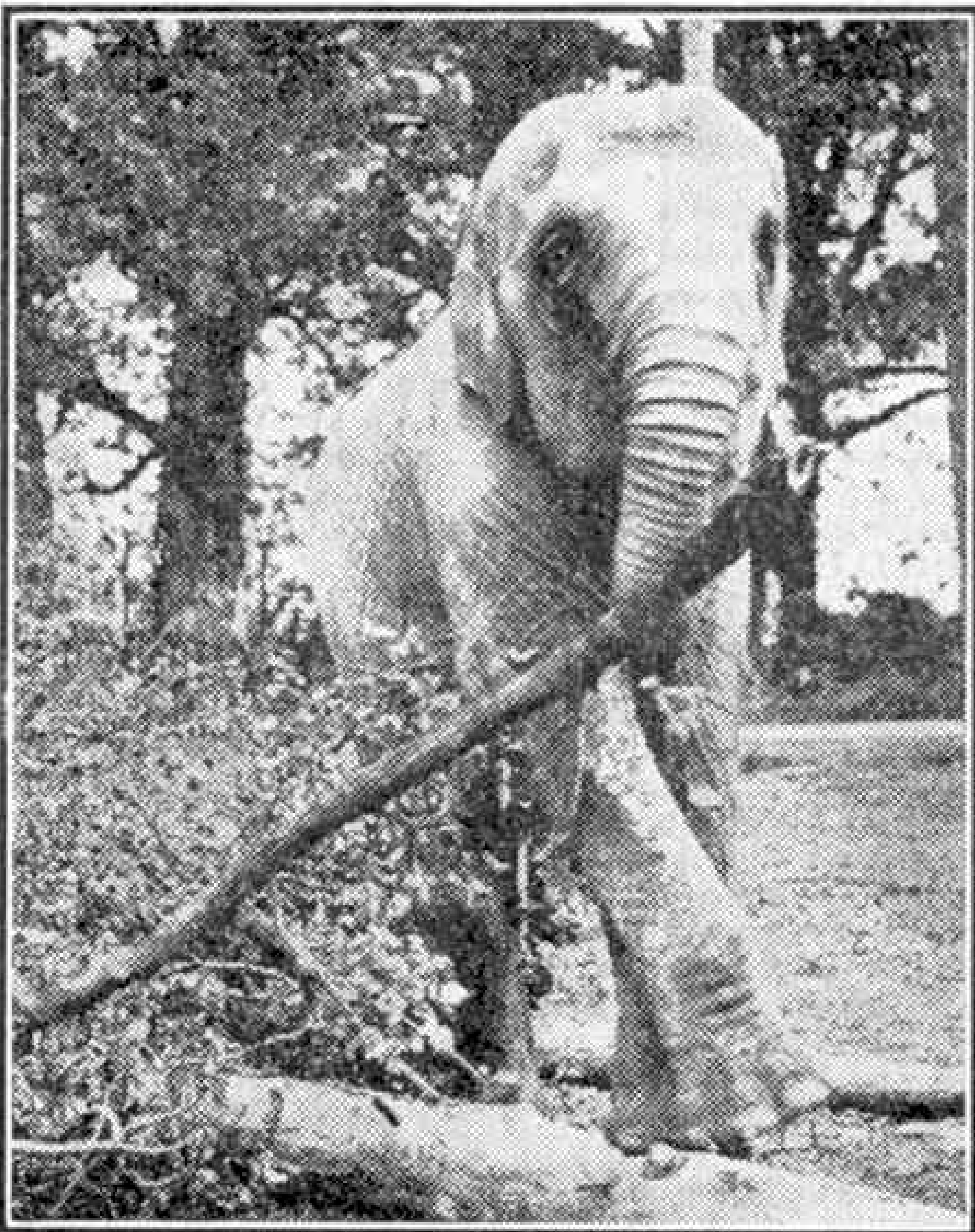
"Dixie" enjoys helping the keepers at Whipsnade with their winter logs.

long before they are once more back in our care.

The steam crane and overhead trolley have gradually replaced elephant labour at the more up-to-date yards, but in the forests, where the trees are felled, they are employed in ever-increasing numbers. Here they pull the heavy logs out of the mud, and work them in the streams. When the logs get stranded in shallow water, these sagacious beasts place their foreheads against one end of the log and slide it over the ooze into deep water. When jams occur the elephants loosen them and set free the mass. Better than their drivers, it is said, they know which is the log that binds the rest together, selecting it unerringly, and tackling it with prudence and sagacity.

It is very seldom that an elephant gets out of hand and causes trouble. All adult male elephants, however, are subject to attacks of musth, a curious form of temporary insanity. It is thought to be due to an overcharging of certain glands. It is a simple matter to discover when an elephant is likely to be affected in this way, and to ward off the condition by steady work and the use of sedative drugs. At the lumber camps everything is done to preserve the animals' health. When work is finished for the day the elephants are marched round once to detect lameness. Then each elephant kneels in turn and there follows a detailed examination of backs and eyes, feet and legs. There may be some minor operation to perform, abscesses to cut, wounds to syringe and dress, and medicine to prescribe. A pound of Epsom salts is considered a fair dose. The animals are very valuable, a good working elephant commanding as much as £400 to £600. The working life of these interesting beasts is 50 years.

So far we have only mentioned the Asiatic elephant. There is also the African variety. He is a much bigger animal than his Asiatic brother, weighing from three to four tons. He is of fiercer disposition than the Asiatic type, and is more rapid in his movements. His most noticeable difference in appearance lies in his enormous ears. It has often been stated that the African elephant cannot be tamed and put to work, but this is not correct. The Belgians have a number working for them in the Congo, almost entirely engaged in transport work.



An elephant at work in a private zoo in Surrey.

P.R.U.

II—The Eyes of the Royal Air Force

By C. G. Grey

Founder of "The Aeroplane" 1911, Editor until September, 1939

WHEN those in High Places saw in July, 1939, that war must come, the most important problem before the Admiralty was to find out where the German High Seas Fleet was, and to make sure that it did not break out and begin raiding our shipping on the Atlantic. We were not at war, so we could not send either Naval (Fleet Air Arm) or R.A.F. aircraft over German waters to find out. Then, two or three days before war was declared, there arrived in the Admiralty a batch of photographs showing clearly, though in minute size, the chief units of the German Fleet at anchor off Wilhelmshaven in the Heligoland Bight.

They had been taken without orders, request, or collusion by a Mr. Sidney Cotton, a private owner-pilot from his own aircraft. And every day till war was declared he used to hand in a fresh lot of pictures,

before the war he was concerned with the Dufaycolor system of colour photography.

Fixing up deals in this business took him all over Europe, especially to Germany, so he bought a small fast twin-engined Lockheed plane, which he enamelled white, and tuned up so that it reached heights and speeds which none of its breed had done before. And he discovered that, at 20,000 feet and above, it was invisible and inaudible from the ground. Naturally he fitted it for photographic work. And in his experiments he found how to divert air from the warmed cabin out round his cameras so that they did not fog or stick or crack films. And that was the secret of his Wilhelmshaven pictures. The authenticity of the pictures was later confirmed by the great contouring apparatus, which Major Hemming had imported. It, I believe, produced pictures

which told the Navy's experts precisely which ship was which.

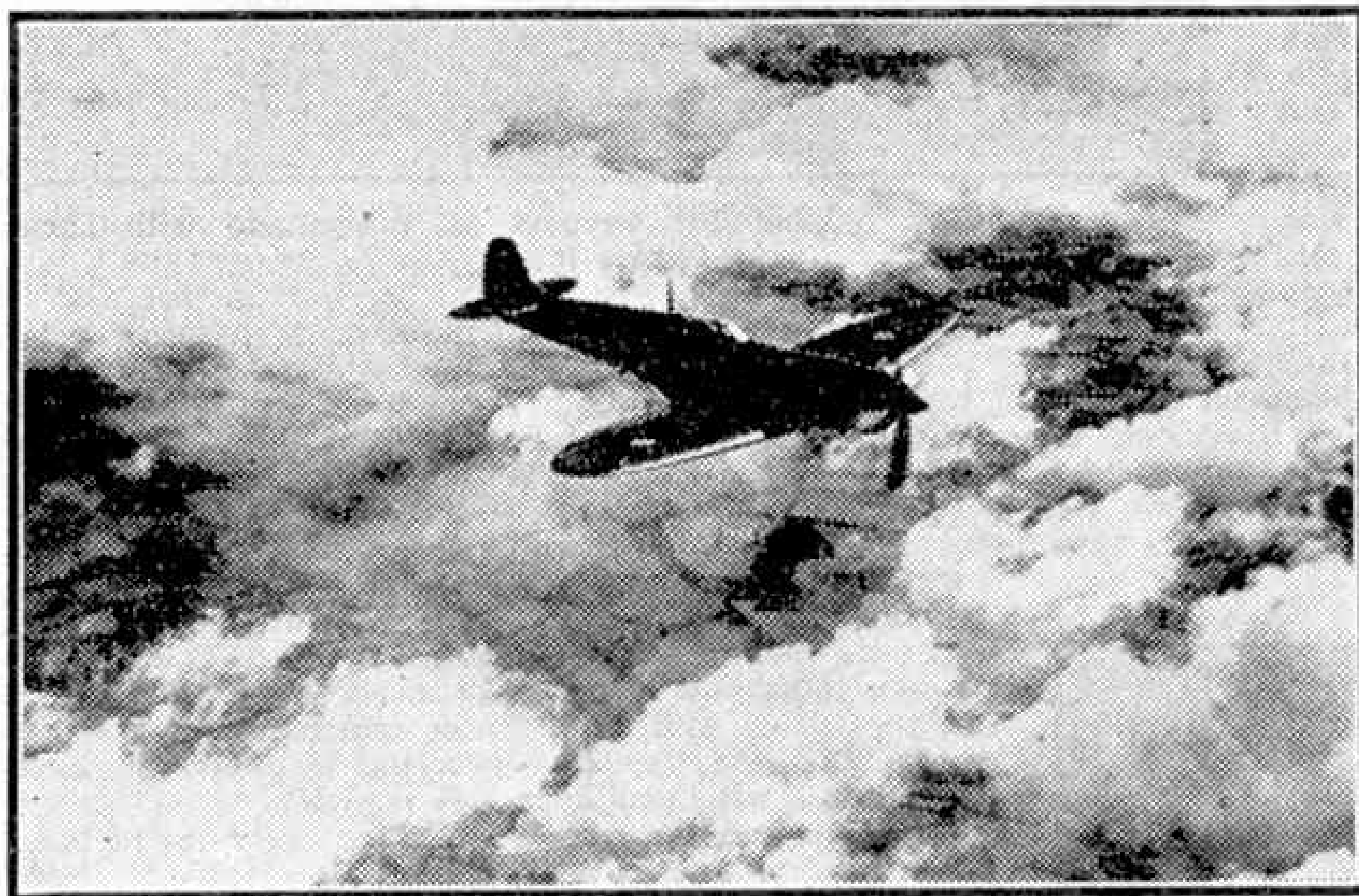
Flying back from Germany, one morning early, just before the war, across Holland, he happened to look back when just over the Dutch frontier, and saw a string of ships in the Wilhelmshaven roads. Their shadows in the low sun made them noticeable. So in due course he went and photographed them, with effects which I have told.

These pictures naturally caused some excitement among the Air Staff, who wanted to know how they were done. Cotton told them that the pictures were taken with a standard R.A.F. Williamson "Eagle" camera, and that if they would take him into the R.A.F. and give him some aircraft to pull to pieces and fix up for reconnaissance he would develop the best photographic scouts in the world. A highly intelligent Intelligence Department took him at his word, and he delivered the

goods. They gave him a shed on a London aerodrome, they let him pick his pilots and mechanics and gave him a free hand to do what he liked. And his outfit was called the Photographic Development Unit, or P.D.U.

By that time the R.A.F. was trying to get pictures of the German Rhineland defences—stupidly called by us the Siegfried Line. There was no bombing of land targets, because of some sort of ungentlemanly agreement, but photography was permitted, if one could do it. Our "Spitfires" shot down German photographers over France, and we lost dozens of "Battles" and "Blenheims" and "Lysanders", over the Rhine, and got mighty few pictures. So Cotton faked up some "Blenheims," by a simple alteration of the cooling of the engines, and by stopping holes and cracks in the fuselages, and pushed the speed at low levels up to 300 m.p.h., at which the "Messerschmitts" of that time could not catch them. And the R.A.F. got its pictures.

Then he set to work on "Spitfires," two or three of which he borrowed from Air Chief Marshal Sir Hugh Dowding, now Lord Dowding, then Air Officer Commanding-in-Chief, Fighter Command. First of all he turned the machine into what was practically

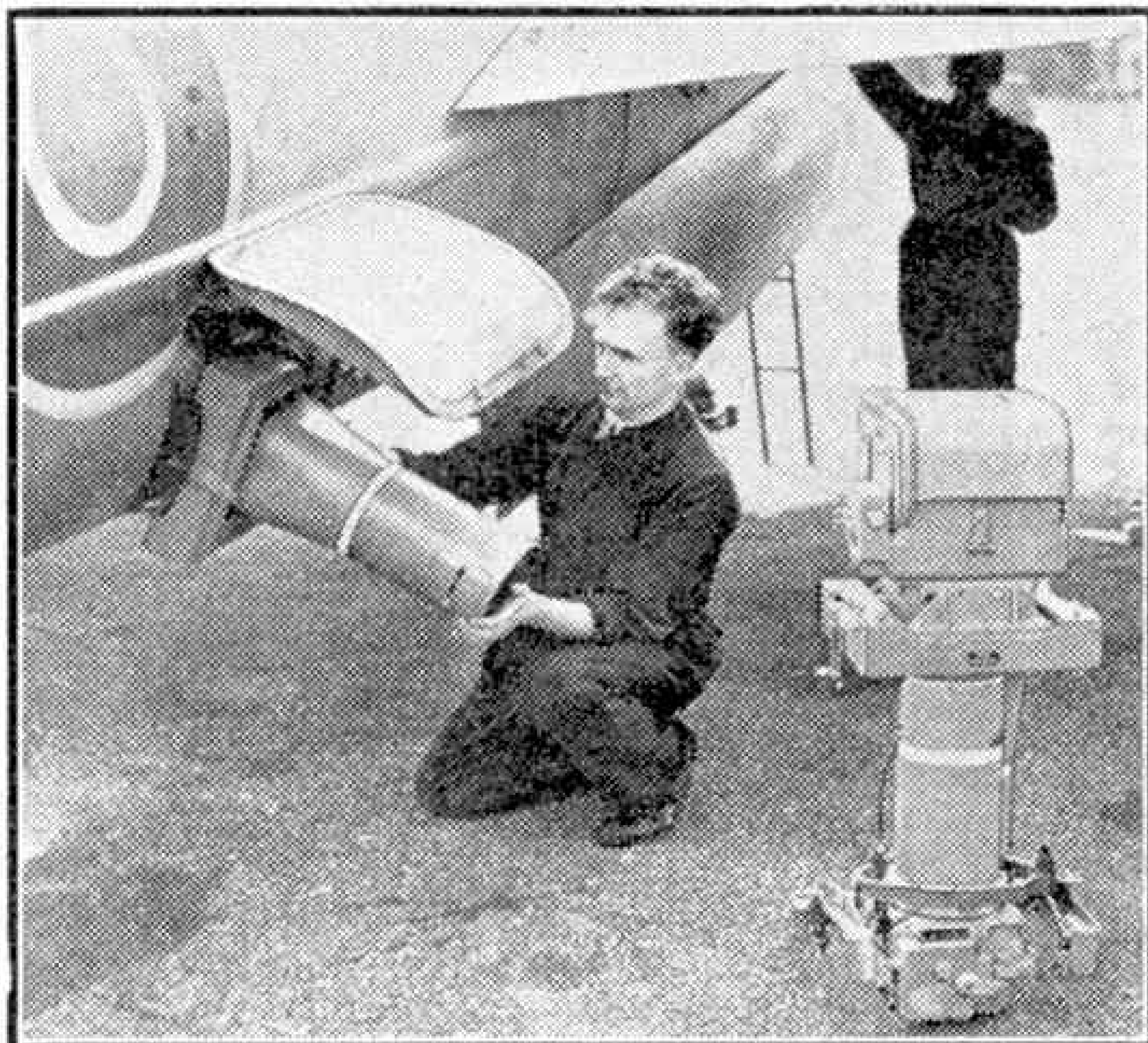


On the way up! A P.R.U. "Spitfire" over low cloud, apparently 3,000 ft. or so above the ground.

taken that morning, to show that the Fleet had not moved.

On the day war was declared, September 3rd 1939, the R.A.F. sent over a batch of bombers and battered those ships somewhat. We lost some aircraft and we did little damage to the ships. But we gave the Germans a promise of things to come. And there is interest in noting that on Christmas Day, 1914, half a dozen or so of our Short seaplanes, from small carriers in the North Sea bombed Wilhelmshaven (nearly 25 years before) and that on January 27th, 1943, just about a year after the Pearl Harbour episode, the first bombs dropped by the U.S. Army Air Corps on German soil, fell on Wilhelmshaven. Also we tried out some of our first block-busters on Wilhelmshaven. It must be an uncomfortable place.

Sidney Cotton is the son of an Australian cattle king. He was already well known in 1918 as the inventor of the Sidcot wind-and-weather-proof flying suit. He flew in the Royal Naval Air Service and R.A.F. in the last war. Then he took to air survey and flew in Newfoundland and the Labrador, working with Mr. Alan Butler (aforementioned) who was then planning to develop Newfoundland's timber. Later he came back to England, and a few years



Fettling up the "Mosquito." Here the cameras are pushed up into the aft end of the fuselage, instead of being lowered into it, as in the "Spitfire." A hand inside the machine pulls the camera into position.

a flying petrol tank, leaving just room for the pilot and the cameras.

Cotton pushed the range of the "Spitfire," which was about 750 miles with its guns and all, up to far more; and he put their speeds up to some fantastic figures by stopping cracks and painting them with hard enamel, which was polished to make it slip through the air better.

Also he arranged three cameras, more or less shamrock fashion, so that the middle one pointed vertically down and those on the sides outwards. Thus with the automatic cameras ticking away busily all the time, he could photograph a strip of country 20 or 25 miles wide from 20,000 ft. or so, at more than 300 m.p.h., with plenty of speed in hand with which to run away if attacked. Later this system was given, like all our new ideas, to the U.S. Army. A few months ago a beautifully illustrated article appeared in a U.S. paper, describing the whole system in detail as an American development in air photography—and Sidney Cotton is an Australian anyhow.

During the Sitzkrieg, or Phoney War, before the Germans broke into Holland and Belgium, we knew that the official maps of Belgium, where we should have to fight, were deliberately distorted, so as not to give exact artillery ranges to possible invaders. When the time came the P.D.U. got to work and produced a correct map of Belgium in three days—helped by good weather, happily. They had already mapped thousands of square miles of the Rhineland and many German cities without any loss of P.D.U. pilots or machines.

After the downfall of France, on the day when Italy came into the war, a section of the P.D.U. flew to the Riviera—to San Raphael, the French air station. Thence a subsection flew to Corsica. In one day they photographed the Italian Fleet in the

Bay of Naples, half a dozen of the chief industrial cities of Italy, and most of the strategic points in Italy, including the Brenner Pass and other Alpine entries—which may still be useful. And they were back in London with their photographs that evening. Also their ground crews who went to attend to the engines and cameras, duly flew back in their Lockheed "Hudsons."

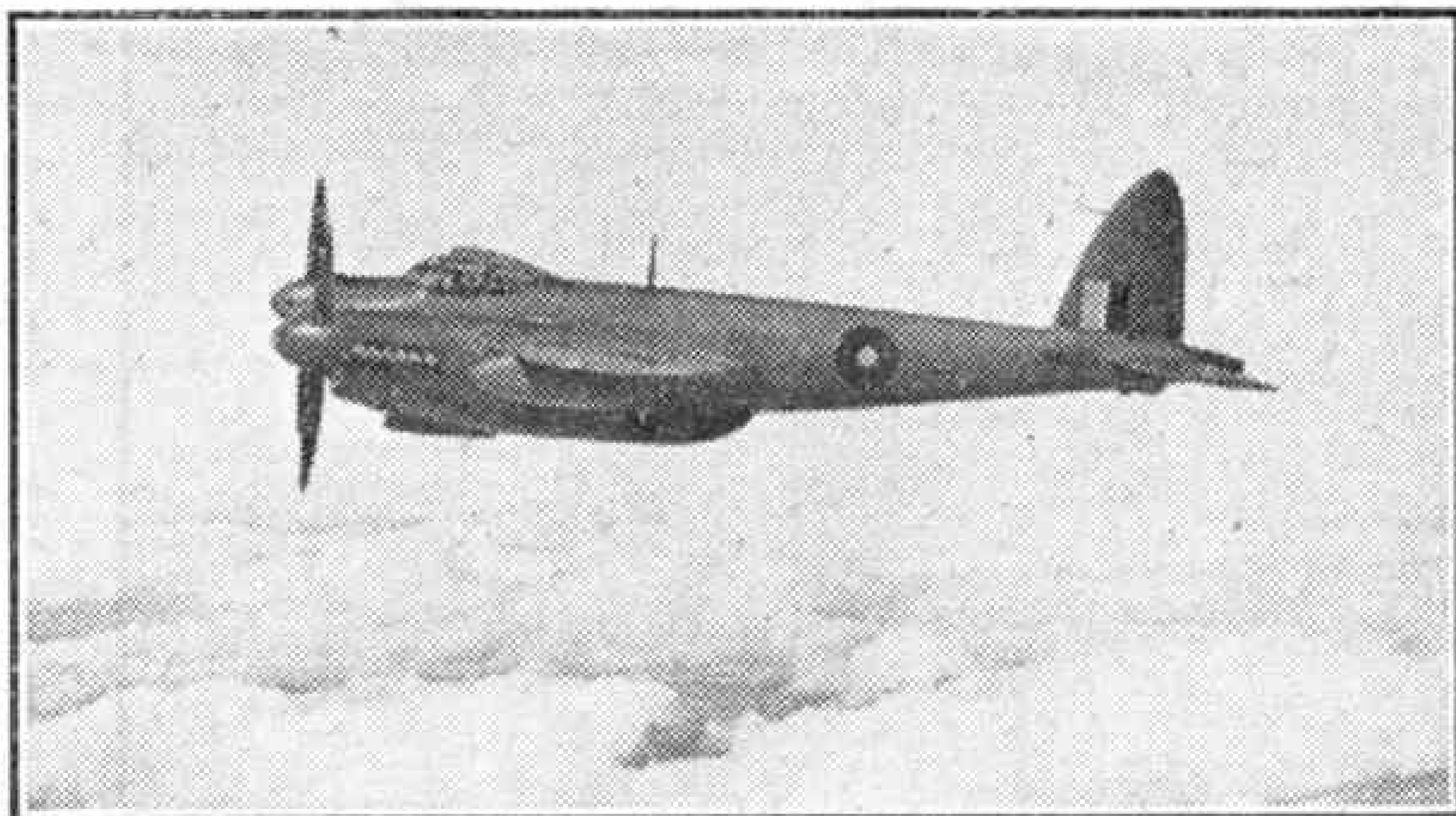
Certainly the P.D.U. did a grand job of work, and the R.A.F. to-day owes a great debt of gratitude to Sidney Cotton and to the High-Ups at the Air Ministry who had the courage to give him and his wild men of the P.D.U. a free hand to go where they liked and do what they liked just how they liked, so long as they delivered the goods, which they never failed to do.

By 1941-42 the P.D.U. had grown so big and so important that the Air Staff decided that it must be brought into the regular R.A.F. and could no longer exist as a sort of privateering, almost piratical, organisation inside the Service. So a senior R.A.F. officer was appointed to command what was now called officially the Photographic Reconnaissance Unit, or P.R.U.

No better choice of an Air Officer Commanding could have been made. I must not mention his name, but I may say that he has already distinguished himself as a pilot of high speed aircraft, and as a bomber pilot, and as a commander of big bomber stations, and that he still flies the P.R.U. "Spitfires" and "Mosquitoes" with as great skill as can any of his pilots.

To-day the P.R.U., with newer and hotter aircraft, and better and better cameras, are growing more and more valuable to the R.A.F., but the people of this country know little about them. Before every bomb raid pictures must be taken to show all details of the targets. After every raid the P.R.U.'s must go and photograph results.

Without decrying in any way the skill and courage of our bomber crews, one may still admire the work of the lone P.R.U. pilot, who, instead of making one glorious dash through the flak and searchlights and flares and fighters, and so home, has to sit up over the burning or burnt-out city, waiting for a clear spot between clouds, or picking a proper position in relation to the smoke, to get what the Air Staff wants to know, and meanwhile keeping a lookout to see that no enemy fighter in a special anti-photographic machine, with special wings or engines, has climbed up above him and is coming (Continued on page 70)



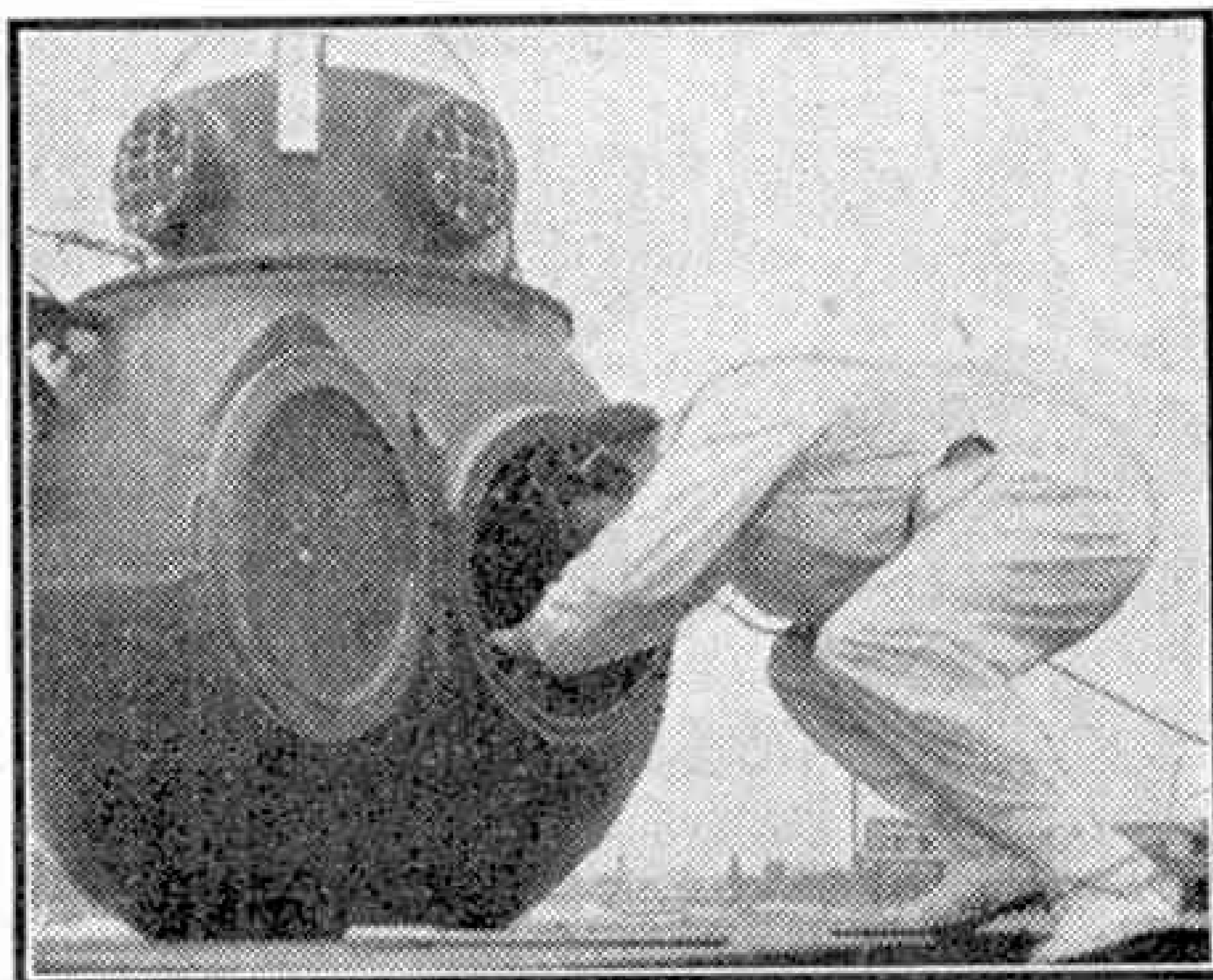
A photographic "Mosquito" just above low cloud. Note how the machine is streamlined to the last ounce.

Giant Tongs to Raise Sunken Ships

By Michael Lorant

SPECTACULAR opportunities for salvaging sunken vessels seem to be provided in a sensational device for that purpose designed by a deep sea diver of long experience. Its inventor believes his proposal should prove of immediate value to the United Nations in putting hundreds of torpedoed ships back into commission quickly. He is Lieutenant Harry E. Rieseberg, an American, an authority on sunken treasure reclamation, whose adventures have recently been recounted by himself in his book *"I Dive for Treasure."* He advocates an arrangement resembling a floating drydock to which sunken hulks could be raised by mammoth tongs. His invention, projected to receive ships up to 40,000 tons, would cost no more than one large freighter, and would be capable of raising craft from depths previously undreamed of by salvage companies.

This gigantic device, designed to raise



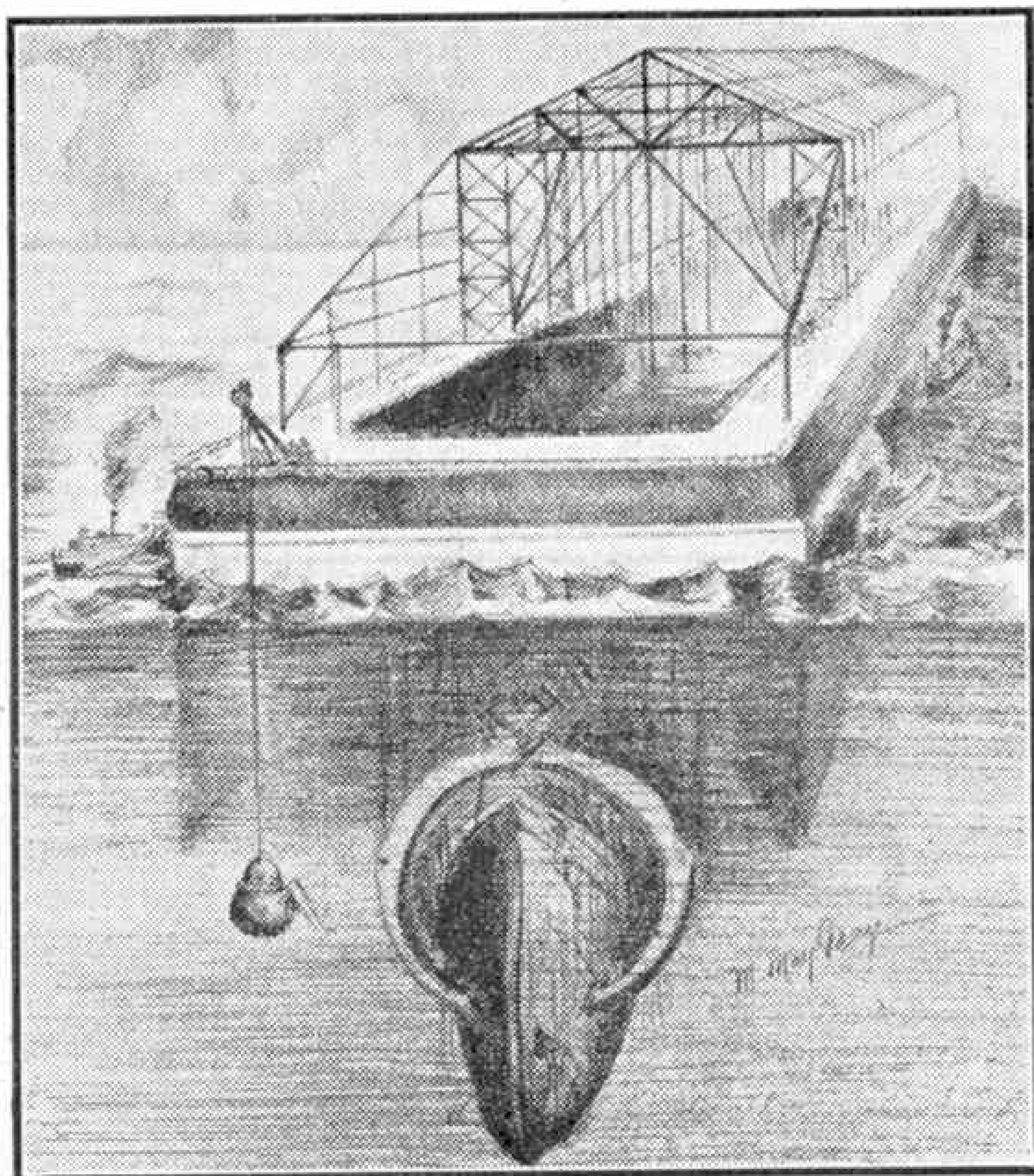
Lieut. Rieseberg entering the control robot.

through 3,000 ft. of pressure-packed sea water hundreds of torpedoed United Nations' merchantmen and other craft, has been hailed by many marine engineers as one of the first major contributions to come out of the present war. The invention is actually a huge floating drydock pontoon fitted with a giant grappler system. Based upon the pontoon theory for floating support, the proposed drydock is 520 ft. in length and 210 ft. in width, with a depth of 80 ft. from the running deck to the bottom of the float.

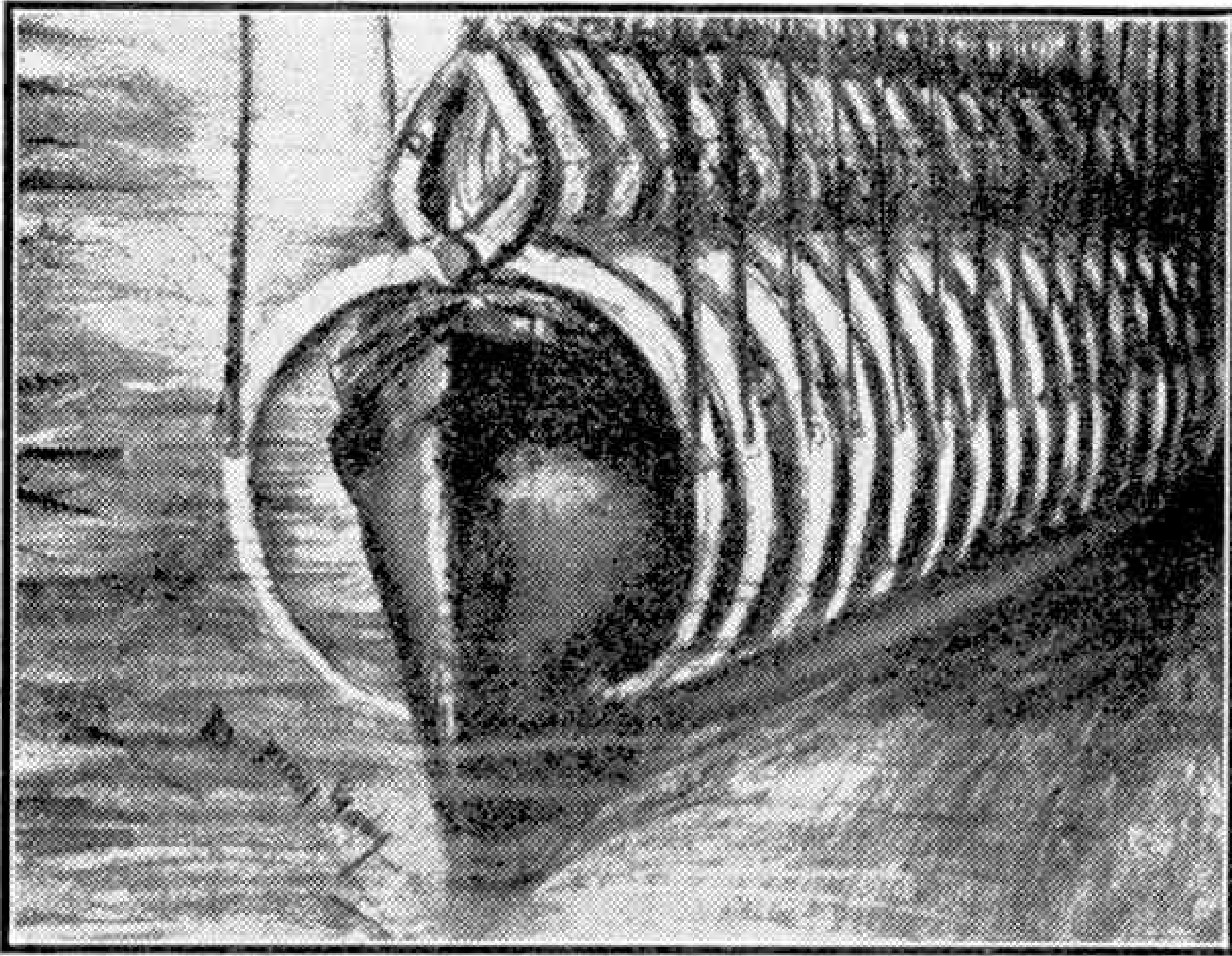
From a massive 460 ft. well in the centre of the drydock, 16 steel grapplers, each 180 ft. from tips to axis, descend over the sunken hulk, gripping and raising it into the well.

The function of these grapplers is to do away with the necessity for sending divers down into sunken hulks to do a tedious and dangerous work that is possible only at limited ranges of depth. Lieut. Rieseberg claims that his invention eliminates entirely the use of divers in suits, such as are used by all commercial salvage processes to-day, and which dare not penetrate to any working depth below 300 ft.

The mighty steel fingers will spread wide open on their downward plunge, and claw through great thicknesses of mud, sand and coral formation to bedrock in order to disclose encrusted wrecks. Then they will slowly close in, and start their upward haul with the wreck clutched between their blunted tips, and



Drawing of the floating drydock and well. Illustrations copyright by Lieut. Harry E. Rieseberg.



How the grapplers will grip the sunken craft prior to raising it.

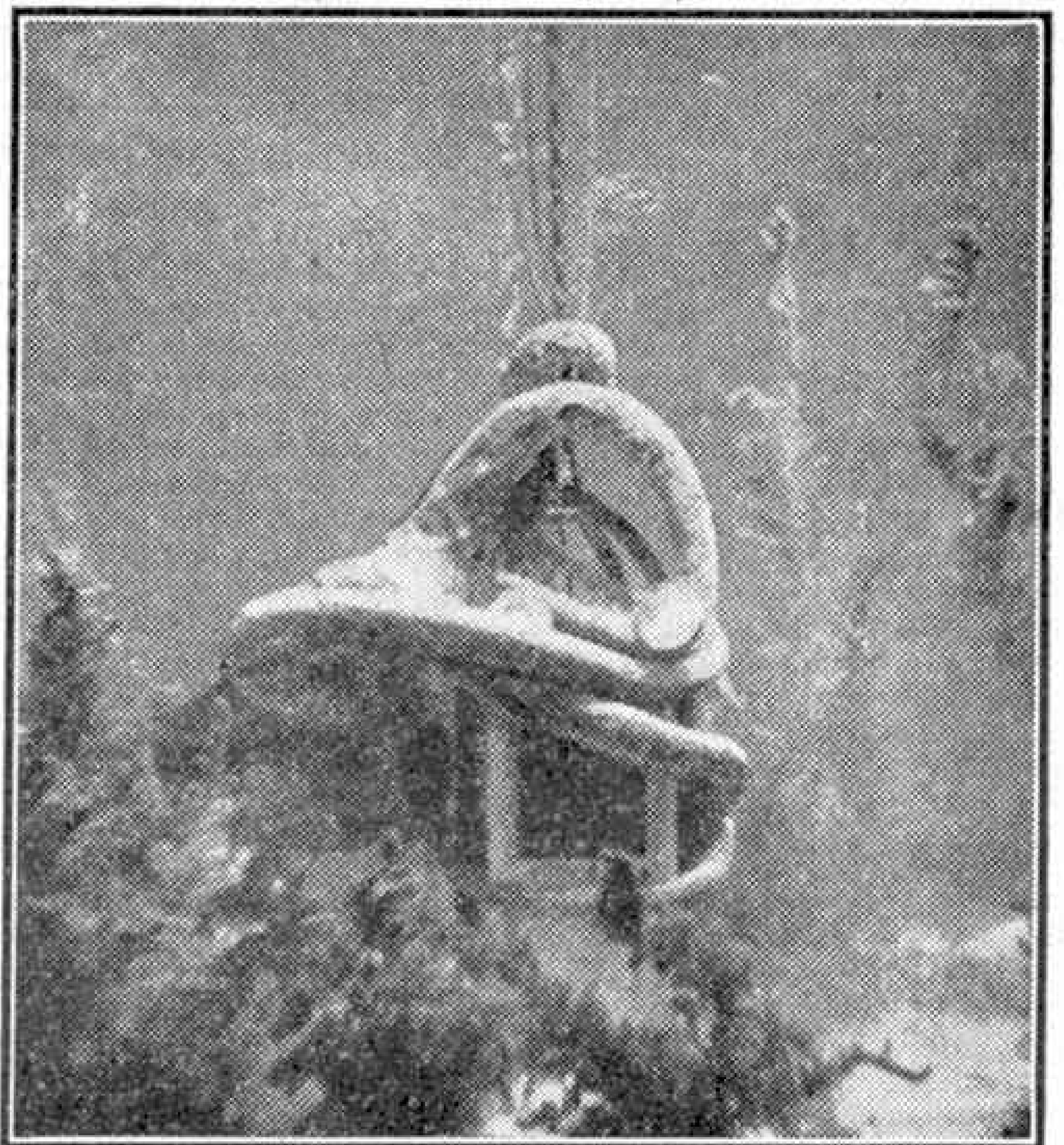
land it into the waiting well intact. Expert marine authorities declare the salvager will lift wrecks from depths ranging to 3,000 ft.—depths at which no salvage operations have operated as yet.

The operative machinery consists of an intricate system of 30 hoisting machines carrying 190,000 ft. of steel cable for a 3,000 ft. range of operation. With this equipment the device will lift a wreck from depths of 2,500 ft. or 3,000 ft. in 12 hours. Even so, some experts who have been asked to comment on this invention and have pronounced it revolutionary in its element, observe that its size and slowness in transit to the point of operation would make it an easy enemy target in wartime. Yet for post-war operation it would be invaluable, paying for itself in its first salvage undertaking.

As far as the peacetime feasibility goes, history furnishes the inventors with ample assurance that the sea holds tremendous unrecovered treasures, all apart from what has gone down to the bottom since the present war began. In 1893, Lieut-Commander Richardson Clover, once chief of the hydrographic office of the United States Navy, said that reliable statistics showed an average of 2,172 vessels to be the annual loss of world craft at that time. While sinkings do not always involve treasure of value, 25,000,000 tons of shipping were lost in World War I.

World War II, now in progress, has exceeded that figure by many thousands of tons, and is still sending many more thousands to the bottom, with aircraft, ammunition, guns, tanks, and much-needed materials that would be of invaluable use for post-war reconstruction. Sunken argosies of the days of the Spanish and Portuguese explorers and pirates are supposed to represent fabulous sums still challenging recovery efforts.

A control robot-sphere, already constructed and in use for salvage work, weighing 3,900 lb., will be used to direct operations beneath the water at great depths. Other cables will carry current for powerful search-lights and telephone wires. Oxygen tanks, instead of the traditional airhose, are part of the robot's equipment. Thus the diver-operator of the control robot—the only man involved in this gigantic undertaking—may remain under the sea as long as 12 hours at a time on the responsible job of directing the operation of these 16 huge grapplers.



A huge octopus attacks the control robot that dares to intrude into its underwater realm.

Railway News

L.M.S. Locomotive Notes

Rebuilt "Royal Scots" Nos. 6103, 6108 and 6109 have recently been noted working Midland Division Anglo-Scottish expresses over the difficult Leeds-Carlisle section with loads up to 14 bogies. New class "5" 4-6-0s numbered 5475-85 are allocated to the Scottish area. Further 83xx standard 2-8-0 engines are appearing, also more of the 86xx series built by the S.R. When being "run-in" from Brighton, these locomotives haul freight trains or work otherwise as required to Worthing or Three Bridges.

Midland class "3" 4-4-0 engines of the original Belpaire fire-box type are still seen on that Division taking a useful share in various workings. At the beginning of October last two of them, Nos. 755 and 759, were seen together on an up fast train from Bedford to St. Pancras. U.S.A. 2-8-0s, former L.N.W. 0-8-0s, and "Beyer-Garratts" of the first series, such as No. 7998, are reported to have been on Midland freight trains, which are very numerous in the London area.

In commemoration of the honour recently bestowed upon the brave island of Malta by H.M. The King, "Jubilee" class 3-cyl. 4-6-0 No. 5616, hitherto "Malta," was renamed "Malta G.C." by Lieut.-General Sir William Dobbie, the former G.O.C. of the island. The ceremony took place at Euston, and was presided over by the Chairman of the L.M.S. The engine was in charge of a driver who was awarded the Military Medal during the last great war, while the fireman had taken part in the evacuation from Dunkirk during one of the grimdest phases of the present conflict.

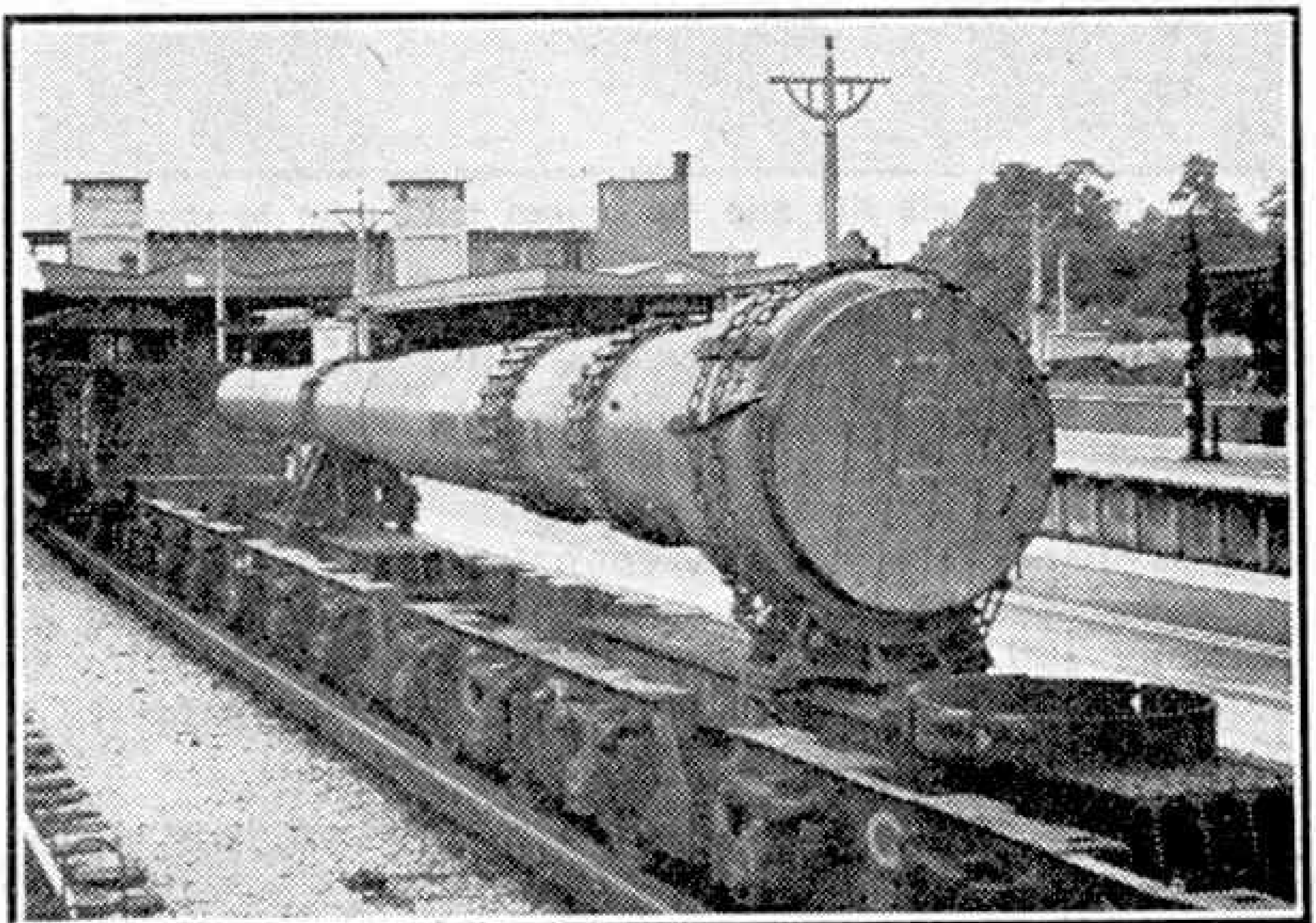
Various ex-Highland Railway locomotives are still doing useful work north of Perth, including "large Ben" 4-4-0s. Of the three Highland 0-4-4Ts, class "OP" in the L.M.S. list, Nos. 15051/4 were last noted at Inverness. No. 15053 operates the far-North Wick and Lybster branch. An observer writes: "There is no spare engine for that job, so when 15053 breaks down buses are run instead!" This little engine has an interesting history. She was built in 1890 as a saddle-tank with an old, shortened boiler as No. 13 "Strathpeffer." In 1901, after renumbering to -53, she was rebuilt as a side tank with Drummond boiler, presenting a neater appearance and looking similar to the small 0-4-4 tanks on the former L.S.W.R. In 1903, over 40 years ago, she was transferred to the Wick-Lybster branch and appropriately renamed "Lybster." In current L.M.S. practice the number is 15053, but the name has gone.

Southern Tidings

All the "King Arthur" 4-6-0s that were recently sent to the L.N.E.R. are now back in the south. Some of them are still green. One of them, No. 744 "Maid of Astolat," has recently been doing some more "exploring of pastures new," having reached Swindon Junction, G.W.R., with one coach, probably by means of the erstwhile Midland and South Western Junction route, now G.W.R., from Andover on trial, with a view to special working if necessary. As examples of the variety of locomotive power to be seen in the course of a month or so on one goods train between Bournemouth and Eastleigh the following

selection is interesting: "King Arthur" No. 806 "Sir Galleron," the last of the class; "Schools" 4-4-0 No. 903 "Charterhouse"; Urie "King Arthurs" back from Newcastle; "S15" and "H15" mixed traffic 4-6-0s of older and newer groups belonging to various Western section sheds; a "Q" class 0-6-0; a U.S.A. 2-8-0, on trial from Eastleigh; "Lord Nelson" No. 862 "Lord Collingwood," and finally No. 448 "Sir Tristram," the first "King Arthur" proper, with eight-wheeled tender and full-gauge boiler mountings and cab, etc., now black. "Sir Galleron" and "Charterhouse" are both Eastern Section engines, which had been through shops at Eastleigh.

The "wings" of steel plate projecting from the sides of the smoke-box fronts that were long characteristic of L.S.W.R. and other engines are



Big guns are moved on British railways. Photograph by courtesy of the Southern Railway.

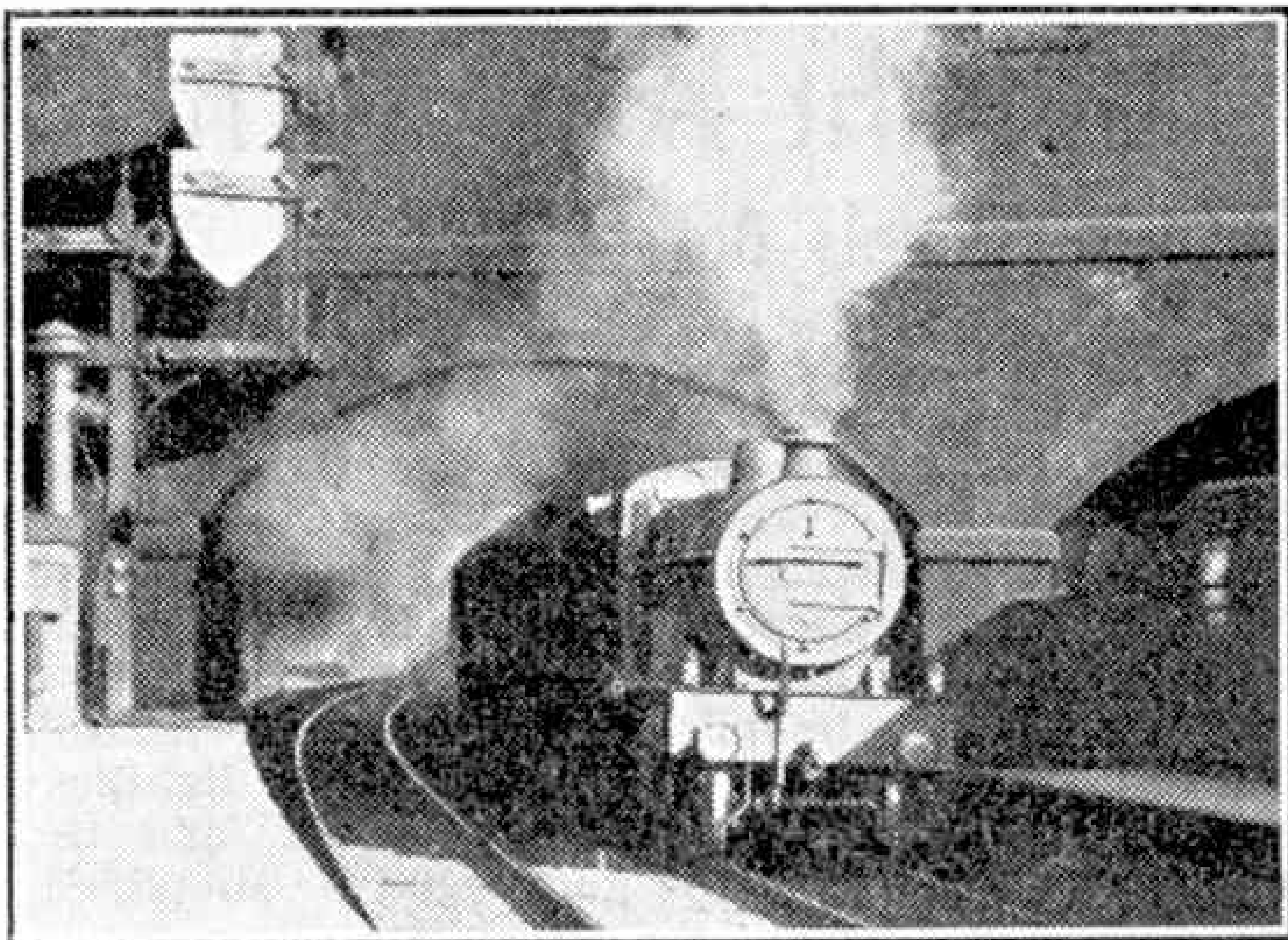
being removed from many of the intermediate express and mixed 4-4-0 engines of the "Drummond" "L11" and "K10" classes.

A Family Signal Box Service

A remarkable feature of the L.N.E.R. Manchester district is the number of women employed at present in signal boxes in unusual circumstances. There is a signalwoman who occupied a similar post during the last great war; another on the Sheffield main line whose father is a special class signaller at a particularly busy and important box near by; two girl friends who have moved from job to job together since schooldays. Now, at Reddish, Mr. Attwood and his wife work different shifts in the same box, one relieving the other!

Remarkable Lightweight Articulated Engines

Beyer, Peacock and Co. Ltd. have recently constructed and shipped to Brazil four remarkable articulated "Beyer-Garratt" locomotives having the 2-4-2 + 2-4-2 wheel arrangement. The requirements and limitations of the metre gauge Cantagallo branch of the Leopoldina Railway, for which they have been built, are very severe, with gradients as steep as 1 in 30, extremely sharp curves, and light bridges and track, restricting axle weight to below 9 tons. These locomotives have a tractive effort at 85 per cent. boiler pressure of 18,000 lb. although their total



St. Pancras-Derby express passing Kentish Town. The engine is a standard Midland 4-4-0 compound. Photograph by A. G. Williamson.

weight is only 69 tons. At each end there are two outside cylinders, each 11 in. in diameter with 20 in. stroke, actuated by oscillating-cam poppet valve gear. The coupled wheels are 3 ft. 4 in. in diameter; boiler pressure is 175 lb. per sq. in., and a steel fire-box containing thermic syphons provides a grate area of 30½ sq. ft. Coal capacity is 2½ tons; water, 1,700 gallons. The fire-grate and ashpan have been specially designed for burning Brazilian coal on the assumption that better quality fuel cannot be imported at present.

Articulated engines of this pattern, both large and small, can work trains in both forward and reverse gear and are economical as well as powerful. Beyer, Peacock and Co. Ltd., writing recently with reference to "Beyer-Garratt" engines in general, fitted with Walschaerts gear, pointed out that the two engine units are duplicate as regards valve gear, which is designed so as to obtain very nearly equal results in both gears, in contrast to the usual tender engine practice of paying special attention to the forward gear at the expense of the backward one.

Huge Freight Traffic Figures

Some official figures recently made public give yet another clue to the enormous freight traffic that the British Railways are handling. In one week on the L.N.E.R. alone 324,825 loaded wagons were forwarded from stations, an average of over 46,000 per day, Sunday and weekday, thus constituting a new record. From three stations only, 22,732 tons of tomatoes were forwarded between June and the end of August to the Midlands and North in well over three million packages. Tonnage figures are going up and up as the peak requirements of the Services, of industry and of food supply are met.

G.W.R. 2-4-0T "Lady Margaret"

A familiar locomotive on light duties in the Oswestry district on the former Cambrian Railway during recent years was a 2-4-0 tank with a tall, slender chimney and plenty of brasswork about the "Great Westernised" boiler fittings. Although she bore a G.W. number

plate, No. 1308, she was obviously not of Swindon origin. She also had the unusual distinction for a tank engine of a name "*Lady Margaret*."

"*Lady Margaret*" was built in 1901 by Andrew Barclay, Sons and Co., for the then privately-owned Liskeard and Looe Railway in Cornwall, being taken over by the G.W.R. in 1909. Dimensions published in 1933 included the following figures: coupled wheels 4 ft., leading ones 2 ft. diameter; inside cylinders 14½ in. by 22 in. stroke; boiler pressure 140 lb. per sq. in., total weight only 30 tons.

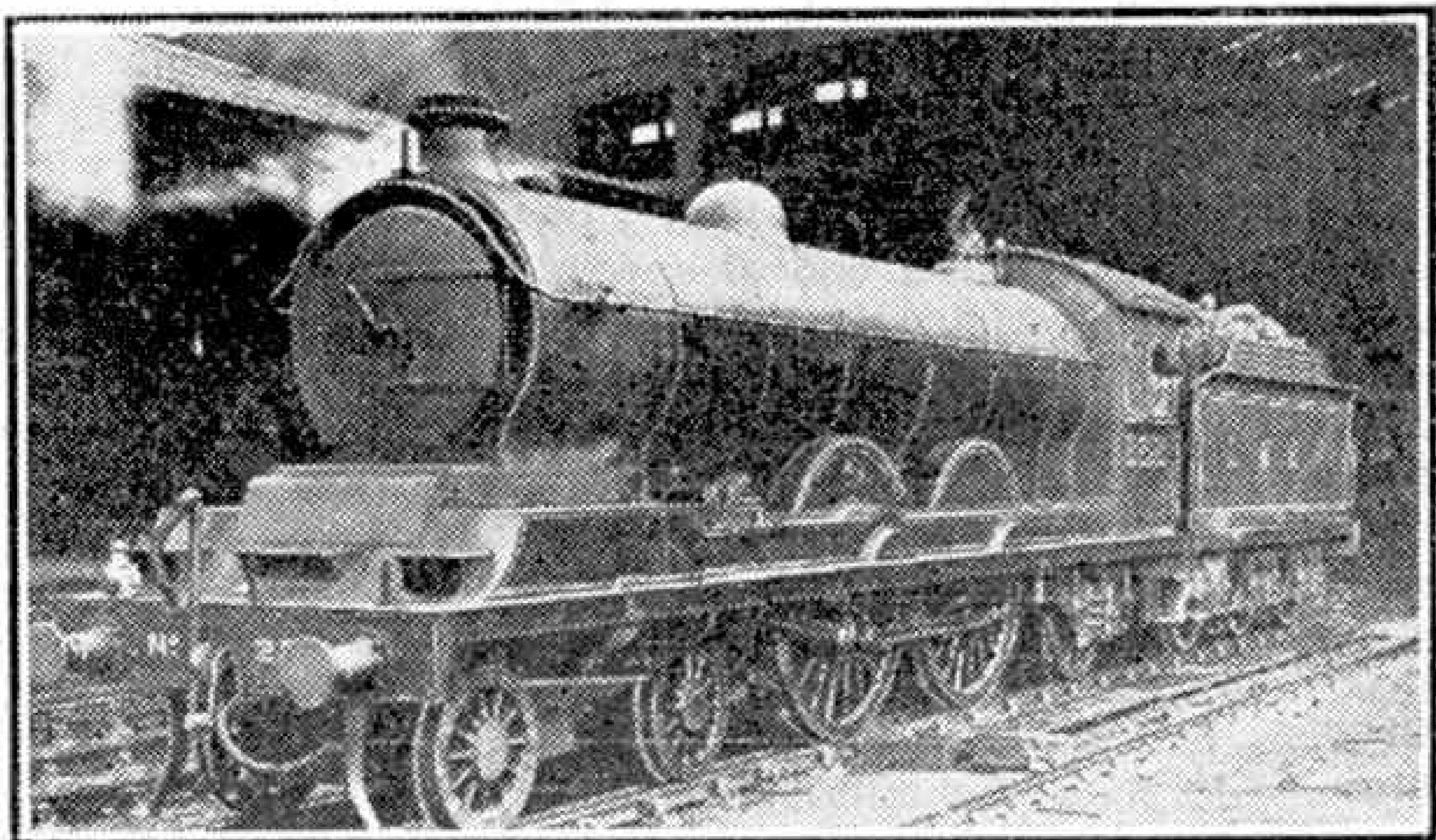
Recollections of Slip Coaches on the S.R.

It is perhaps difficult to realise now that quite a number of slip carriages were detached daily in the old days of three main separate companies in the South of England, and particularly on the former London, Brighton and South Coast, and South Eastern and Chatham Railways before 1915, now forming respectively the Central and Eastern sections of the S.R. Actually there were 21 on the former system and eight on the latter. Stations at which slipping of coaches took place included East Croydon, Horley, Haywards Heath, Barnham Junction, Polegate, Ashford, Tonbridge and Faversham.

Up to 1932, just before the electrification of the Brighton main line, a few "slips" were still being operated by the S.R. in the Central Section on evening business expresses from London Bridge, Saturdays excepted. The 5.5. to Eastbourne, worked by an "Atlantic" in the older days, slipped a portion at Horley for Three Bridges, East Grinstead and Forest Row. The following 5.8 fast to Worthing, via Preston Park curve and Hove, slipped at Haywards Heath for intermediate stations to Brighton. On Saturdays a Three Bridges "slip" for the East Grinstead and Ashdown Forest line was carried by the 5.20 from Victoria. These interesting workings disappeared in the spring of 1932.

Stretches of Line Without Junctions

Over most parts of England the railway network is



One of the "C7" 4-4-2 express engines of the large North Eastern 3-cyl. class. These engines were class "Z" in pre-grouping days. Photograph by W. H. Whitworth.

so interwoven that it is exceptional to find a double-tracked section of any of the four main systems that neither forms a junction with, nor is crossed by, another line over a distance of 30 miles. We know of only one such instance, the 31 miles between Seamer Junction, near Scarborough, through Filey and Bridlington to Driffield, in Yorkshire on the way to Hull.

Have You Ever Thought About This?

Why Don't Gun Barrels Burst?

By Denis Rebbeck, M.A. (Cantab.), A.M.I.Mech.E.

IN the early days of field guns and naval guns, the range and the muzzle velocity of the shell were very limited, due to the fact that the barrel of the gun would burst if a certain explosive charge was exceeded; this was because the strength of the barrel was not very great.

As time went on it became obvious to everyone connected with guns that some way must be found of increasing the strength of the barrel by other means than merely making the walls thicker. Various methods were tried out, leading eventually to the introduction of shrunk-on sleeves, or tubes of steel, and also wire winding.

The first named process consisted of making a second, or outer, barrel, which was heated so that it would expand sufficiently to enable the gun maker to slip it over the real or inner barrel. When this outer tube cooled it contracted and gripped the inner barrel very tightly right round its circumference and throughout its length, thus giving the required extra strength to the barrel. This process was very satisfactory, but expensive, and naturally the guns that were so manufactured were heavy, as well as taking a fairly long time to produce.

The other process mentioned above was the wire-winding one, and in this case the barrel of the gun was revolved slowly in a centre lathe while a coil of special wire was wound very tightly round the circumference. In some cases more than one layer of wire was wound round the barrel. The great disadvantage of wire winding was that production was slow and expensive. If the wire broke when it was being wound on to the gun, as often happened, the whole slow and arduous business had to be begun all over again. This made scientific minds think of ways and means whereby a good gun barrel could be produced quickly and cheaply and be strong without being too heavy.

It was discovered by experiment that if some practical way could be devised of permanently stretching the inside layers of the gun barrel—that is giving them a permanent set, or “elongation” as engineers say—the outer layers would be slightly stretched, and in attempting to regain

their normal position they would exert the necessary compressive force on the inner layers of the barrel. This would enable gun barrels to be produced that would be cheap, comparatively easy to make and quite light. For anti-aircraft guns, which have to be quickly traversed and elevated to all sorts of positions, this lightness would be of enormous benefit, and the balancing of the gun would be simplified.

Eventually the difficulties of producing the necessary conditions and pressures were overcome, and gun manufacturers began to learn a new method of gun building called “auto-frettage” or self-hooping. By suitably producing an enormous hydraulic pressure, they were able to permanently stretch the inside layers of steel in the barrel, that is, the layers of metal next to the bore. This made the outside layers very annoyed at being slightly displaced, or “put out,” as human beings sometimes are; so that they in turn exerted a tremendous compressive force on the inner layers of the gun in trying to resume their normal position. The gun manufacturers were naturally delighted. This tremendous compressive force did exactly what the shrunk-on sleeve and wire winding had previously done. It did something else too. It quickly eliminated all faulty barrels, for if they could not stand this terrific hydraulic pressure they expanded and blew out like balloons, and sometimes even burst; and it was naturally much better that their flaws should be discovered in the factories than in action.

Auto-frettage is a comparatively simple process, and was used in ordnance factories by many countries before this war.

By the auto-frettage process the manufacturer produces a sound barrel that is superior to the sleeved or wire-wound gun in many ways. The secret of the process is that the gun barrel has been made strong enough to withstand a far higher pressure than it will be subjected to every time a shell is projected from it. Thus it has a high safety factor, and can be used for many rounds with complete confidence.

Next time a chum says to you: “I wonder why gun barrels don't burst when a shell is fired,” you will be able to tell him all about it.

Of General Interest

A Walk in a Volcanic Crater

The illustration on this page shows an interested visitor taking a walk in the crater of a volcano. This is Solfatara, near Naples, Italy, and although the volcano is not nowadays regarded as active a tour of its crater is certainly an adventure to be remembered, for hot sulphurous gases are continually being given off along with steam from simmering mud collected in pools. The last recorded eruption of Solfatara occurred 750 years ago.

Volcanoes are always of the greatest interest, whether they are fiercely active monsters, liable to sudden eruption at any moment, or are extinct. There are probably over 1,000 on the Earth, and about 350 of these are known to be alive. Even those that are thought to be extinct may easily come to life again with disastrous results. Vesuvius is a good example of this. Before its most destructive outbreak, the one in 79 A.D. in which Pompeii was overwhelmed, this volcano had been at rest for centuries. Stromboli, not far away on the Lipari Islands north of Sicily, has been pouring out lava for more than 2,000 years, and so presents a remarkable contrast.

It seems that it is not safe to regard a volcano as completely lifeless until frost and rain have begun to wear it down, as they do the peaks of the greatest of mountain ranges. Volcanoes that are really dead, or rather the remains of them, are to be seen in the Hebrides. For instance, in the island of Mull a group of hills 3,000 ft. in height is all that is left of an immense volcano of millions of years ago that rose to a height of about 12,000 ft. Solfatara therefore may again become a really active crater, although at the moment it shows every sign of decadence.

Precious Stones Go To War

An interesting result of war conditions is the growth in the United States of the manufacture of synthetic sapphires. These jewels are used as bearings in watches and delicate measuring instruments. There are about 100 of them in the watches used by the members of the crews of war aeroplanes, while altimeter and revolution counters may have as many as 120 in them.

Jewel bearings are used in enormous quantities. In the United States alone more than 4,000,000 of these bearings are now required every month, and at the beginning of the war no synthetic sapphires were made in that country! A start was made with the industry in 1941, but next year the demand was so overwhelming that sapphires had to be brought over from Great Britain. It takes time to build up

an industry of this kind, as will be understood when it is explained that a jewel bearing undergoes from 40 to 70 manufacturing operations, many of which are complicated. Sapphires are not as hard as diamonds, but they are harder than the hardest steel, besides being durable and resistant to heat, cold and vibration.

Another industry of a similar kind that also had to be developed in the United States after the outbreak of war is the making of diamond dies used for drawing the wires, so small that they are scarcely visible, that are used in telescopic sights and in making radio location equipment.

In this case Britain too gave valuable help, by sending out an automatic diamond drilling machine with explanations of its use and operations. One of the chief problems was the training of the workers, who have to use a microscope in order to follow the progress of their operations. It takes from 130 to 200 hrs. to drill a hole in a small diamond die, although the hole in even the largest of the small dies is only $1\frac{1}{2}$ thousandths of an inch in diameter, and that in the smallest is only a fifth of this size.

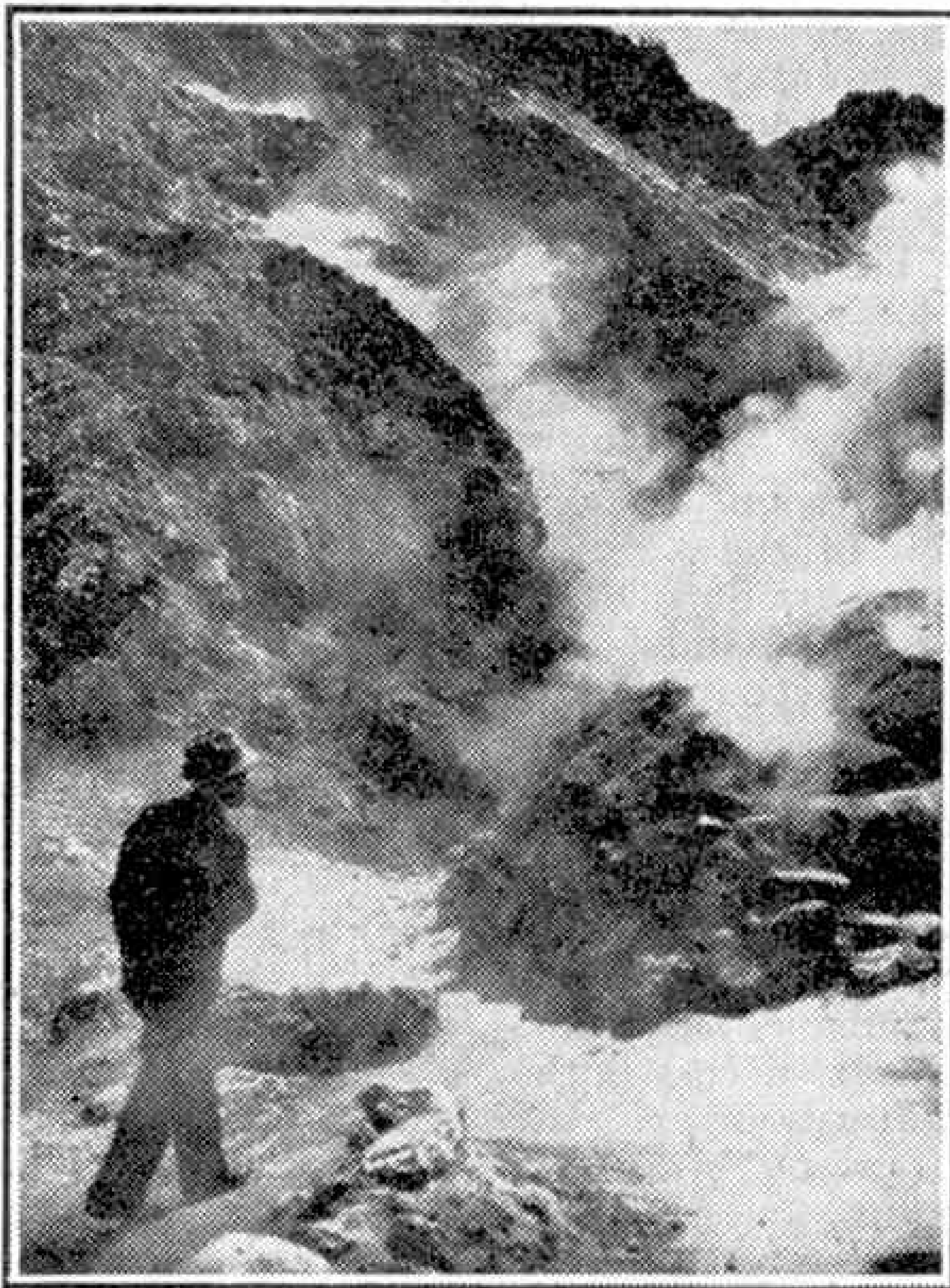
How Long Do Seeds Live?

Many strange tales have been told of grain seeds found in Egyptian tombs that have been planted and have yielded growing plants, although they are 3,000 or 4,000 years old. It is very doubtful if these stories are true, and the greatest age at which any seed has definitely been known to show signs of life is about 237 years. The seed was that of the lotus of the Nile, one of which in the Natural History Museum, South Kensington, was from a specimen of the dried plant in a collection formed early in the

18th century by Sir Hans Sloane. By suitable treatment this was made to come to life and the plant into which it grew is now at Kew.

Cooked in its Own Ink

Many tales have been told of the octopus, usually regarded as one of the terrors of the seas. Yet the creature is really timid and retiring, and it is doubtful if it would attack a man unless fairly cornered and driven to fight. It prefers to withdraw into some remote corner, throwing out a cloud of ink to cover its retreat. It is a repulsive creature. Probably the fear of it has arisen from its appearance, and it is safe to say that man is more dangerous to the octopus than the octopus is to man. Strange though it may seem, it provides really tasty meals, and because of this it is hunted in the West Indies and in Southern Europe. It is said that in Spain it is cooked in its own ink, making a black and unattractive looking mess that nevertheless tastes good.

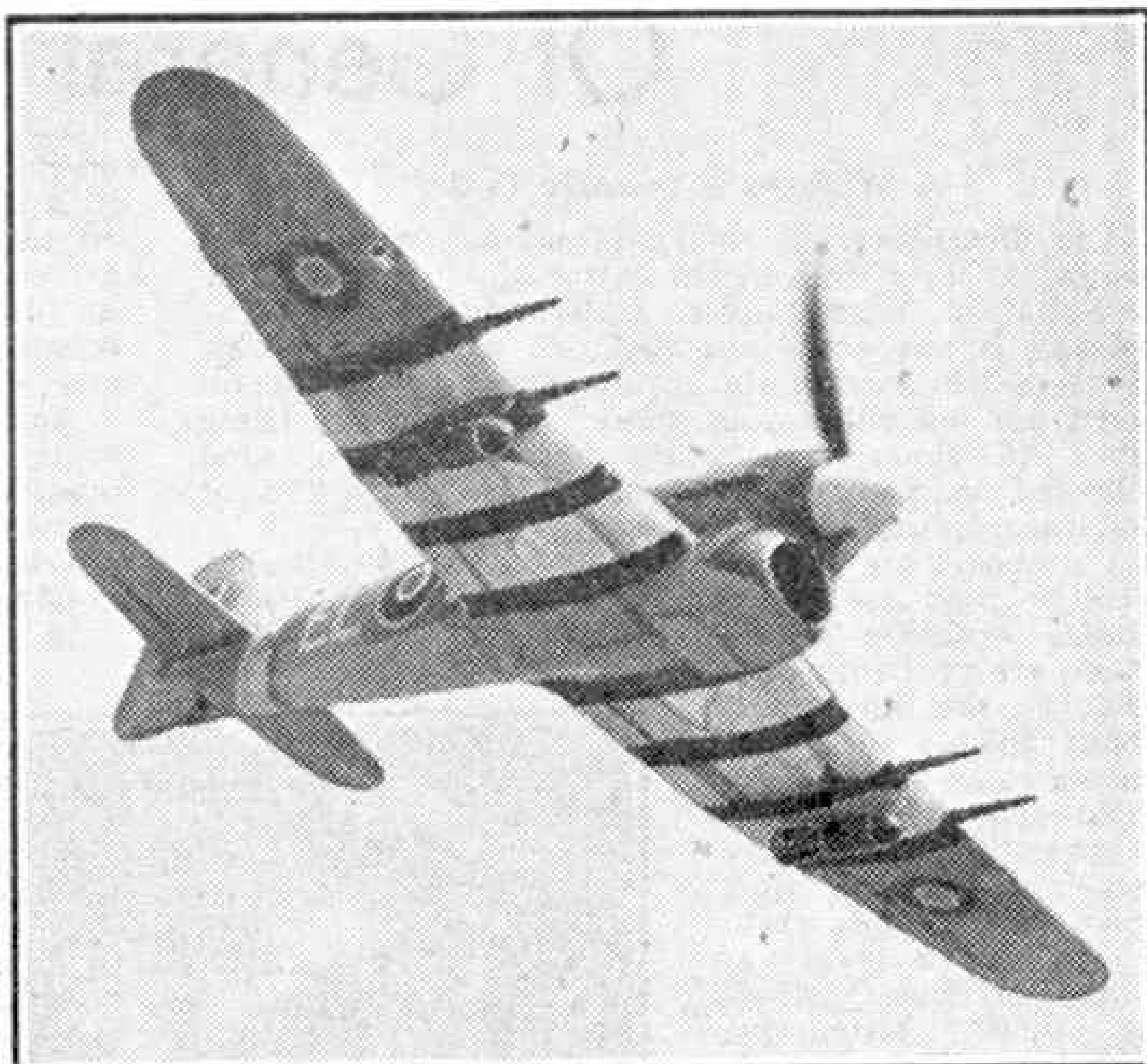


A curious place for a walk. Our illustration shows the interior of the crater of Solfatara, the Italian volcano, with poisonous fumes and steam rising from pools of simmering mud. Photograph by J. D. Robinson, Darlington.

The Hawker "Typhoon"

THE Hawker "Typhoon" made its first flight in February, 1940, and was the first new type of British single-engined fighter to go into service with the R.A.F. since the war began. During last year many of the R.A.F. single-engined fighter squadrons operating from bases in this country were re-equipped with this aircraft, the successor to the "Hurricane" IIs they had been using. The "Typhoon" has now been on active service for about a year, and has established itself as a first-class defensive and offensive fighter.

On the home front it soon began to take heavy toll of the German "hit-and-run" day raiders over South-East and Southern England, and within a few months it had accounted for 50 of these enemy machines. It is no respecter of types, and Focke-Wulf Fw 190's and Messerschmitt Me 210 twin-engined fighter-bombers have been among its many victims, as it is fast enough to overtake any German aircraft in service. On the offensive side the "Typhoon" has been a great success both as a fighter and a fighter-bomber. In innumerable daylight "ground-strafting" sorties over France, Belgium, and Holland

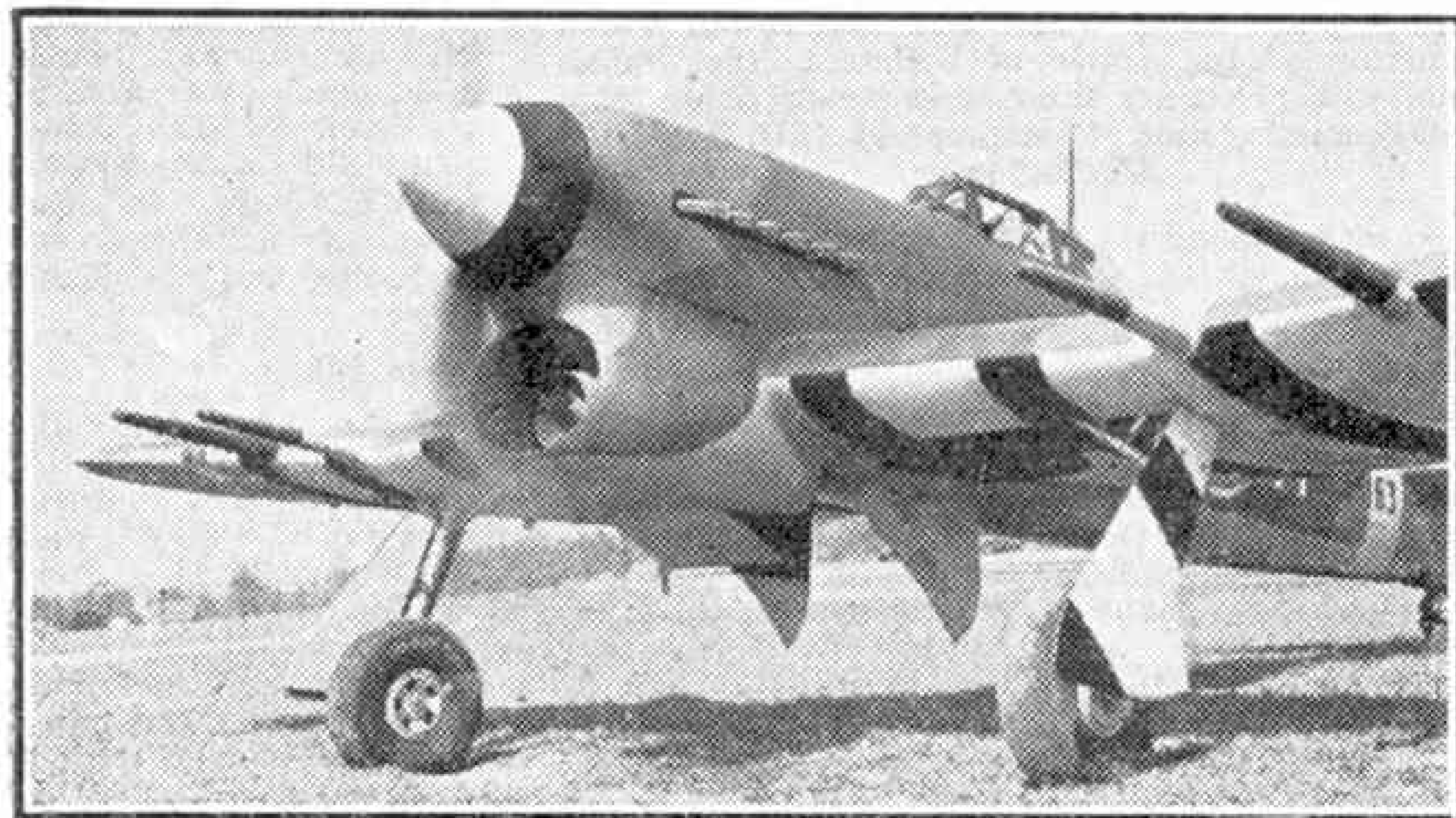


Hawker "Typhoon" IB fighter-bomber, with black and white stripes under the wings as a recognition safeguard, as from certain aspects the machine resembles the German Focke-Wulf Fw 190. Photograph "Flight" Copyright.

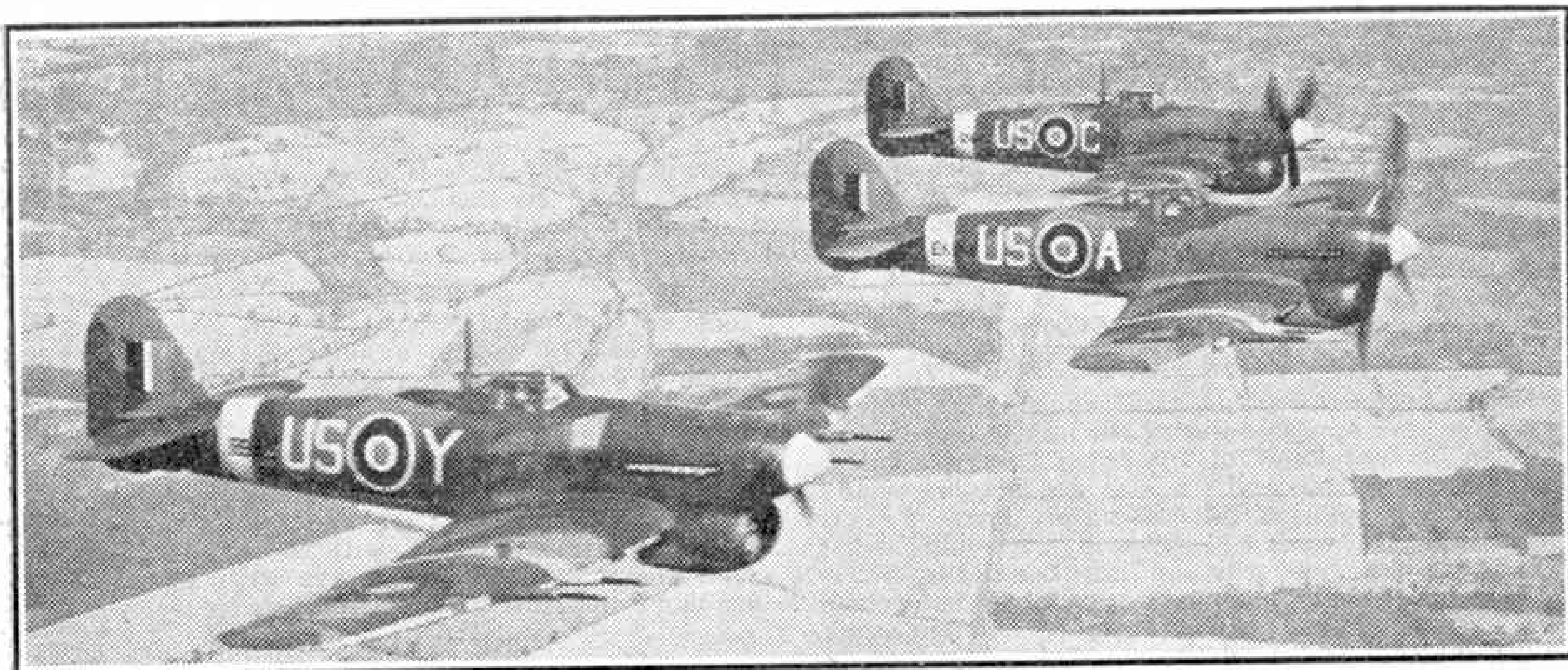
it has destroyed or severely damaged very many locomotives, goods trains, barges, and road transport. One "Typhoon" fighter squadron destroyed 100 locomotives during just over three months' "sweeps." As a fighter-bomber it has carried out daring daylight raids on enemy airfields, railways, and war factories, and has sunk enemy coastal shipping, E-boats, and minesweepers.

The outstanding efficiency of the "Typhoon" is due to its heavy fire power, high speed, and great manoeuvrability, and undoubtedly it is one of the most formidable

fighter aircraft in service to-day. It was planned by the Hawker design team, creator of the world-famous "Hurricane," under their brilliant chief, Mr. Sydney Camm, whose portrait appeared in the article on the "Hurricane" in the December, 1943, "M.M." It was designed as an all-round fighter aircraft, and for production by the now well-known Dispersal system, in which the components are produced by many small factories and



The "Typhoon" IB fighter, showing the engine cowling and radiator, four 20 mm. cannon, and the wide undercarriage. Photograph "The Aeroplane" Copyright.



A flight of "Typhoon" fighters somewhere over England. Photograph "The Aeroplane" Copyright.

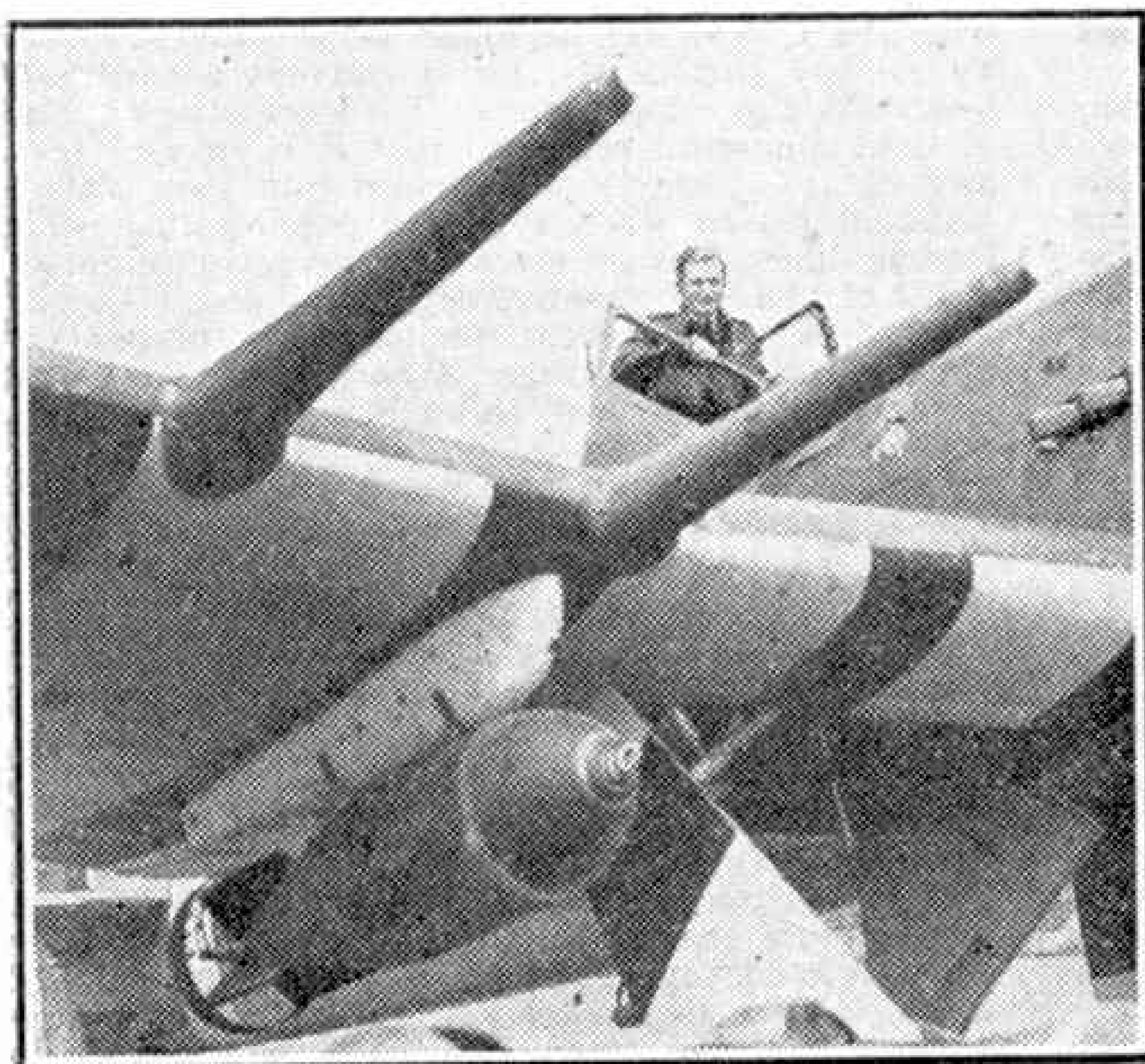
delivered to special final assembly plants, where the machines are completed and tested, and then flown by ferry pilots to wherever the R.A.F. require them to be delivered.

The earliest "Typhoons" were armed with twelve .303 in. machine guns in the wings, and are known as the 1A version. Later came the 1B version, which has four 20 mm. Hispano cannon instead of the machine guns. When it became general practice to equip R.A.F. fighters for duty also as fighter-bombers the 4-cannon "Typhoon" was fitted with external streamlined racks so that it can carry a 500 lb. bomb under each wing. The bombs are of a blast type that is said to

be equal to ordinary general-purpose bombs of double the weight. Both fighter and fighter-bomber versions of the 1B machine are shown in the accompanying illustrations.

The "Typhoon" is larger and heavier than previous types of British fighter aircraft, has a wing span of 41 ft. 7 in., and is 31 ft. 11 in. long. It is quite different from the "Hurricane," and has a stressed-skin fuselage instead of the girder type used in the earlier machine. The fuselage of the "Typhoon" is oval in cross-section, and built of light alloy. The all-metal wings are thicker than those of the "Hurricane," and have landing lights for night flying operations fitted in the outer sections, and navigation lights in the wing tips. The wings slant downward slightly from their junction with the fuselage to where the undercarriage is attached, and slightly upward from that point to the tips.

The "Typhoon" has the new Napier "Sabre" liquid-cooled "H" type engine, which develops 2,200 h.p. The 24 cylinders of this very powerful engine are arranged horizontally in two rows, instead of in the usual vertical fashion, and the ends of the exhausts protrude through the sides of the engine cowling. Each exhaust serves jointly a cylinder in the upper row and one in the lower row. These projecting exhaust stubs can be seen in the lower photograph on the previous page, which shows also the large radiator opening under the engine that is a distinct feature of the "Typhoon." There is a flap at the back of the radiator for controlling the flow of cooling air.



One of the two 500 lb. bombs in position under the wing. Photograph "Flight" Copyright.

BOOKS TO READ

Here we review books of interest and of use to readers of the "M.M." With the exception of those issued by the Scientific and Children's Book Clubs, which are available only to members, and certain others that will be indicated, we can supply copies to readers.

Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 6d. for postage.

"ENGINEERS AT WORK"

By H. E. DANCE (Nelson. 10/6 net)

Many books describing great engineering projects for boys have appeared during the last 10 or 15 years, but we do not know of any other that we can so confidently recommend to our readers, especially the younger ones, as this. It covers broadly many phases of the work of engineers, explaining what they have done, and why and how they did it, clearly and in non-technical language, so that no reader can fail to get a really intelligent grasp of engineering aims, methods and achievements.

The plan followed is to choose some particularly noteworthy example of an engineering structure, such as a tunnel, a bridge or a power plant, and to tell the reader fully how it was built. Mr. Dance begins with tunnelling, and the example chosen is the great highway, the largest of its kind in the World, under the Mersey. We can trace this great project from the first thoughts of engineers about it to the time when it was opened, clean and businesslike in appearance, with adequate ventilation to disperse fumes from motor car exhausts, traffic lights, fire alarms, photo-electric recording gauges and every other detail that could be wished for. The author gives no mere description of the tunnel; he lives through its construction and takes his readers with him.

From tunnels we turn to bridges, and here two examples are chosen—the great suspension bridge across the Golden Gate, San Francisco, the largest in the World, and the magnificent arch bridge spanning Sydney Harbour. The stories of these great structures are told with the same skill and eye for just the right amount of interesting detail that distinguishes the account of the Mersey Tunnel.

Then we turn to the caisson, the remarkable contrivance that allows the engineer to dig down through mud and water to solid foundations for dock walls and bridge piers. The construction of a great dam follows, and this leads naturally to a consideration of power plants, illustrated by the Canadian scheme for getting electrical energy from the St. Lawrence at Beauharnois, near Montreal. Finally we have a splendid account of the extension over Great Britain of the electricity supply grid, and a revealing chapter on measuring time, in which we learn what lies behind our electric clocks.

There are eight full page plates and 205 diagrams, all carefully chosen for the stories they have to tell.

"NATURE IS STRANGER THAN FICTION"

By JOHN Y. BEATY (Harrap. 7/6 net)

This is a book that the keen reader of the "M.M." will delight in having always at hand. We all enjoy learning strange and unusual facts, and these are here in plenty as far as birds, animals, plants, insects and other living things are concerned. There is no continuous story, the book consisting of a series of short paragraphs, each dealing with one special wonder of the world of wild life; and it will provide useful and fascinating reading for spare minutes as well as for long periods.

The book begins well with an ant that weaves silken cloth with a living shuttle. After this we

come to such wonders as a fly that shoots through the air at 818 m.p.h., a living fishing line in the shape of a worm that can grow to a length of 90 ft., animal flowers that lasso their food, soldier ants that spray their victims with acid, a creature that always walks backward, and hundreds of others. Many of these curiosities may seem unbelievable, but each has been carefully checked, and the stories are told in a straightforward way, with the sensations in the facts themselves and not in the writing up. There are many illustrations and a full index.

"THE NINTH LEGION"

By ALLEN W. SEABY (Harrap. 6/- net)

The Ninth Legion was stationed at Eboracum, where York now stands, when barbarians from Caledonia raided Roman Britain. The Legion marched north to meet the invaders and was lost to history from that time. This adds an interesting touch to Mr. Seaby's story, which shows us the men of the Legion at their daily tasks, training and pastimes in Eboracum, and at their summer camp, immediately before they are overwhelmed by the raiders. A British family too comes into the story, and there is a fine account of the adventures of one of its

members who in his youth fought with the armies of Boadicea and afterwards wandered through the great forest that then covered a great part of Britain.

The descriptions of both Roman and British life are enthralling, and the interest of the story is increased by the many excellent drawings that illustrate it.

"A.B.C. OF L.M.S. LOCOMOTIVES"

By I. ALLAN and A. B. MACLEOD

The volume in Mr. Allan's excellent series dealing with the L.M.S. will be found very valuable indeed by railway enthusiasts, for it conveys a wealth of information in compact form. The locomotives appear in it in numerical order, so that it is easy to trace any one. The entries are divided into their classes, distinguished by wheel type and power rating, while leading dimensions are given along with engine names. A list of L.M.S. locomotive depots and codes is given, and there are excellent photographic illustrations and dimensioned drawings. A curious feature is that Walschaerts is spelled throughout as Walchaerts, which is certainly wrong.

The booklet can be obtained from Mr. Ian Allan, 225-7, Laleham Road, Staines, Middx., price 2/-, postage 2d. extra.

"WATCH AND MAKE"

By V. J. G. WOODASON
(Useful Publications. 4/11 net)

This latest book to cater for the model aircraft enthusiast is by the head of a well-known firm of model aircraft builders, and therefore has the stamp of authority. The instructions and suggestions it contains are based on the author's experience, gained during more than 20 years in the business, and he succeeds in conveying something of his life-long interest in his subject to the reader. The thoroughness and simplicity of the instruction given will enable the merest novice to understand the essentials of the art of model aircraft construction. Many fine photographs of Woodason models are reproduced in the book.

Owing to wartime difficulties, it is impossible to guarantee prompt delivery of books ordered as described at the head of this page, but every effort will be made to ensure speedy despatch.

Engineering News

A New Design of Diesel Engine

The marine Diesel engine has been more successful as a large direct coupled unit than as a small high speed engine driving either generators or gearing coupled to the propeller shaft. The success of the large slow running Diesel engine has been partially due to the fact that its particular revolutions per minute, generally between 100 and 140, have been very suitable for high efficiency propellers. For this reason a famous British shipbuilding firm have been working on a new design of double acting two cycle engine which has many advantages. The experimental single cylinder unit is illustrated in the accompanying photograph.

The reader may find it rather hard to understand when he is informed that this particular engine has no less than three pistons in each cylinder! There is, in the centre of the cylinder, the orthodox main piston, which is connected by a piston rod, crosshead and connecting rod to the crankshaft. The stroke of this piston is 47.25 in. At the upper and lower ends of the cylinder there are two further pistons, one at each end, rigidly connected together by four long tie rods placed outside the cylinder and these top and bottom pistons reciprocate together like ordinary pistons and are connected by a crosshead and connecting rods to large eccentrics on the crankshaft. The stroke of these pistons is 15.75 in. The diameter of these top and bottom pistons is the same as that of the main piston; thus there are no cylinder covers, a great advantage, and the cylinder itself is therefore just like a huge plain tube, the diameter of which is 21.65 in. The maximum output of this engine is 1,400 b.h.p. per cylinder at 140 r.p.m.

D. REBBECK, M.A., A.M.I.Mech.E.

Punching Nearly Four Hundred Holes at a Blow

A new die developed by the Boeing Aircraft Company is turning out parts ready for riveting 30 times faster than the previous method of drilling. The new tool is capable of punching 388 riveting holes in a single stroke of a giant hydraulic press, and the parts it makes are riveted together to form the bomb bay/catwalk of the Boeing Flying Fortress.

It is believed that this die contains the largest number of coordinated punches ever placed in a single die. It is spoken of as the "Porcupine" by Boeing employees, because of the similarity between its many punches and a porcupine's quills. It makes a total of 976 riveting holes in the 10 separate parts that comprise the walkway through the bomb bay of the big bomber, and these are assembled with

more than 400 rivets. The web, or flooring, is of aluminium 64 thousandths of an inch thick, but four "T" sections as well as angles and reinforcements also are pierced on the porcupine, the heaviest material being 150 "thous." thick, or more than an eighth of an inch.

The "porcupine" was made to an accuracy of five ten-thousandths of an inch. This ensures absolute alignment of holes from one part to another, so making rapid assembly and greater production possible. The "Flying Fortress" catwalk for which it is used was re-designed to suit it, and as it punches at one time many holes that formerly had to be drilled individually by electrically powered motors its introduction has greatly speeded up production.

The World's First Tunnel

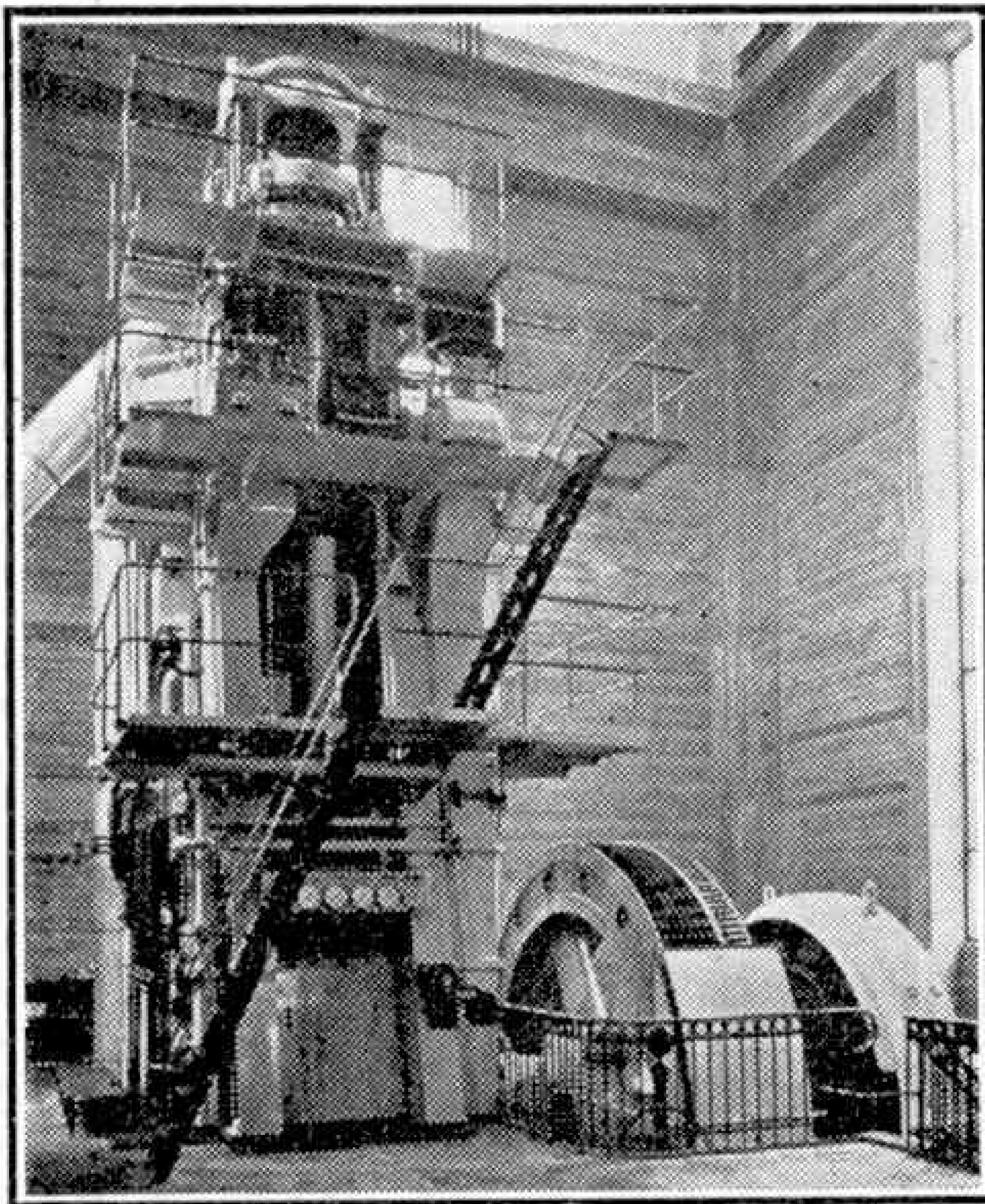
The earliest civil engineer of whom we have any knowledge was a Greek, Eupalinos of Megara, a city near Athens. Megara was remarkable for a water supply system, constructed by Eupalinos, but his most remarkable work is a tunnel on the island of Samos, off the coast of Asia Minor, that so far as we know was the first ever constructed. It was driven about 550 B.C. through hard limestone, and with the crude picks that were then available it is scarcely likely that it advanced at a rate of more than 6 in. a day from each end.

The tunnel is 3,300 ft. long and apparently it was driven from both ends, for the two sections did not meet and a cross tunnel had to be driven to connect the two bores. In its original form it was 8 ft. wide and 8 ft.

high. One of its purposes was to carry a water pipe line from a spring to the city of Samos, and some of the actual clay pipes of the conduit have been discovered. For most of the length of the tunnel the pipe line was sunk in the floor, but in places an open conduit was used. The tunnel seems to have been constructed also to provide a means of escape from the city during a siege. Samos was involved in many wars at this period, for its inhabitants in those early days were little better than pirates.

One Hundred Million Volts

An electric potential of 100 million volts has been reached in the research laboratory of the General Electric Company of America. Such an enormous voltage has never previously been built up, and it is not long since a million volt discharge was looked upon as tremendous. The high voltage has been attained in a device for producing electron streams at such high speeds that they form a new type of radiation, differing in many respects from those with which scientists are now familiar.



An engine that has three pistons in one cylinder. It is an experimental Diesel engine of a novel type. Photograph by D. Rebbeck.

Through the Rockies in a C.P.R. Cab

II—The Climb to Roger's Pass

By Edward H. Livesay

REVELSTOKE is the third Divisional point from Vancouver, 379 miles east; it is very much a "railway town," lying on the banks of the foaming glacier-fed Illecillewaet river among the foothills of the western approach to the towering snow-capped Selkirks, a mighty barrier soaring up into the clouds through which we should soon be threading our tortuous way. Arriving bright and early at the Roundhouse I found No. 5926, a gigantic 330-ton 2-10-4, was to be my chariot of fire, the horses thereof totalling about 5,000; and that Enginemen Brier and Wood were to be my hosts—the former I had travelled with previously. She was the train-engine; our pilot was No. 5900, an equally powerful engine with the same wheel arrangement but of an earlier vintage, the prototype of both classes. Here are some of the leading dimensions of 5926, those of 5900 being much the same, a 275 lb. pressure and 25½ in. cylinders being the chief variations. Cyls. 25 in. by 32 in., drivers 5 ft. 3 in., pressure 285 lb., heating surface 7,086 sq. ft., grate area 93.5 sq. ft., tractive effort 89,000 lb., weight on drivers 138 tons plus 25 tons on the booster-driven axle, engine weight 200 tons. The tender carries 4,100 gals. of oil fuel and 12,000 gals. of water, runs on 12 wheels and weighs 130 tons. The 5900s are magnificent engines, as the upper picture on the next page shows, and the most powerful in use on the C.P.R. The semi-streamlining and general "cleaning-up" of the 5920s have made them very handsome engines, the colour-scheme being black, chocolate and gold.

"The Dominion," waiting in the station, was made up of 16 cars weighing roughly 1,200 tons, and the two leviathans backed down on to it cautiously, one at a time; better not risk 660 tons hitting the coaches even a shade too fast—the shock would be earthquake-like! Sand was laid down on the approach ready for the get-away, made up a heavy gradient beginning right outside the station. Sharp O.T. at 8.50 a.m. the air-whistle in the cab sounded its two cheerful toots, the "Right away!" signal—four, by the way, mean "Test brakes"—and with boosters cut in, both engines dug their toes in, cylinder-cocks viciously hissing and spurting, stumpy chimneys thunderously belching, and the impressive cavalcade began to move out of the Depot up the winding track alongside the tumbling Illecillewaet into Box Canyon and the mountains. The most fascinating part of the transcontinental trip had begun.

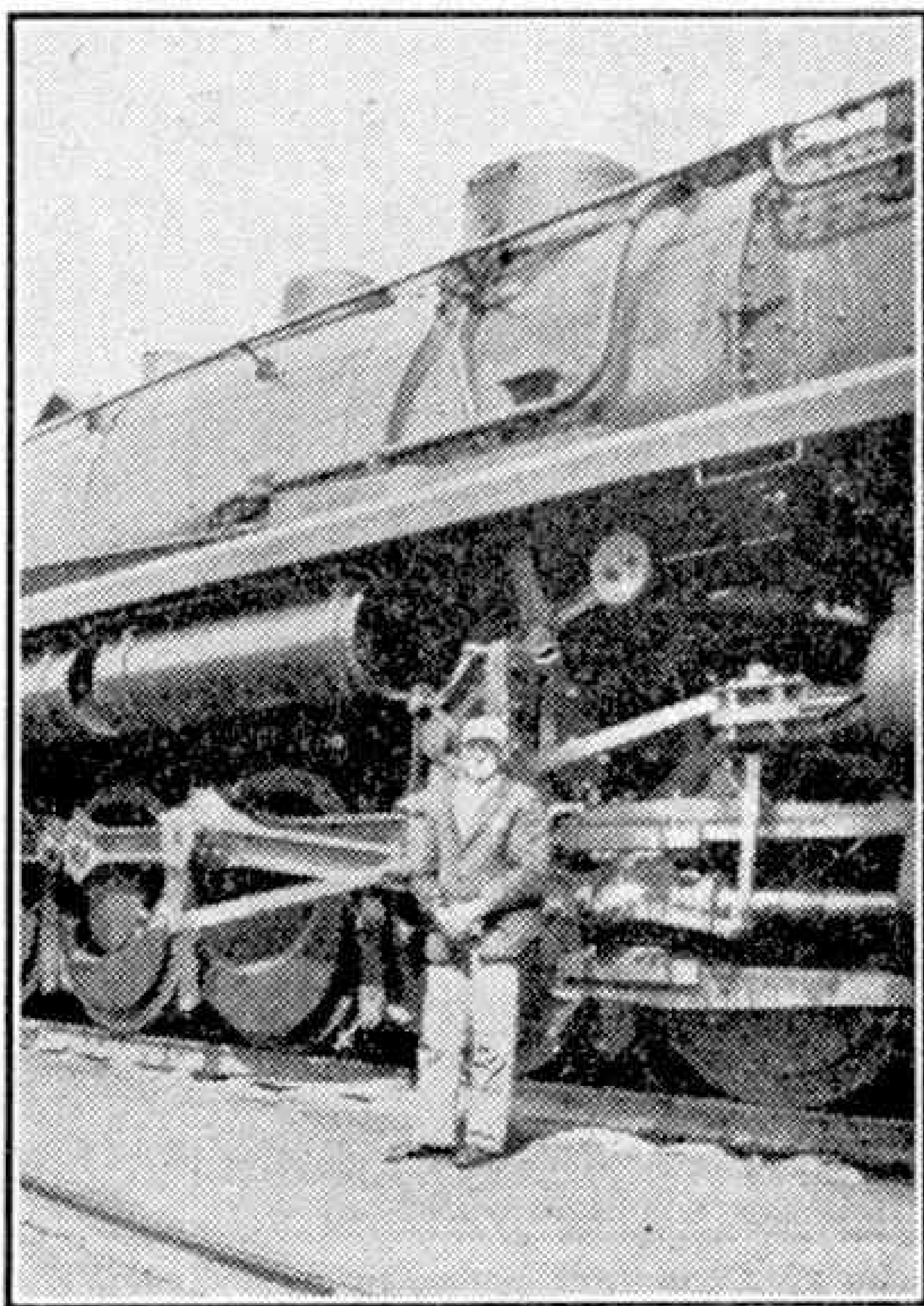
Revelstoke wept at our departure; the clean rain fell from clouds that clung round the fir-clad Selkirks, washing the glistening rocky canyon walls and adding to the mist that drifted in wisps past the cab windows.

The air was cool and utterly pure, smelling of fir and bracken; instinctively I thought of Hindhead and the Devil's Punch Bowl, and then, more appropriate still, of the West Highland line to Fort William and Mallaig. Homesick again—shall I ever get over it? No, not a chance!

But what did the rain matter? The enclosed vestibule cab was snug and weather-proof, the largest and most comfortable I have ever ridden in, clean and dustless. From the deeply padded seat on the left behind Wood I looked ahead through the wind-deflecting glass strip projecting from the side—you

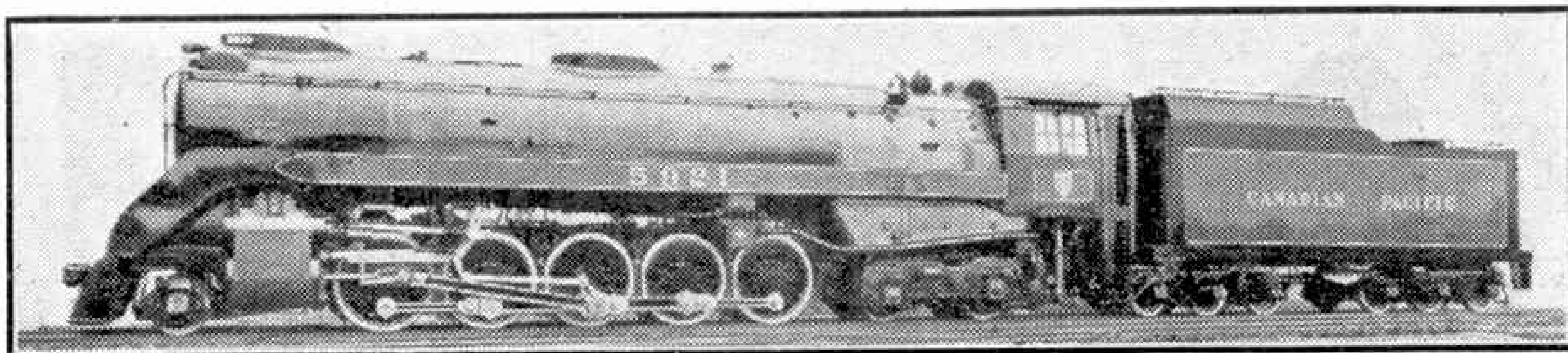
will notice this invaluable sight-saver on "Princess Coronations" and "A4s"—along the great boiler to the roaring streamlined chimney (though you hardly notice it, it is so stubby), and past it to 5900 pulling and tugging away in the lead, valiantly piloting us up the heavy twisty gradient. Looking back there was the cortege of chocolate-coloured cars coiling and uncoiling behind us like a whiplash, bending round the sinuous curves with serpentine grace, little silvery showers of water streaming off the glistening roofs. I pictured the hundreds of passengers cosy and comfortable inside, reading, breakfasting, yarning, or looking out through the rain-streaked windows at the rocky wilderness through which we were passing. But you and I prefer the cab; it is far more interesting than the coaches!

Up, up we climbed, the metals following every contortion of the turbulent torrent boiling alongside, rushing down from its birthplace among the



The author alongside No. 5900

eternal snows that could be seen, glittering and immaculate, high above us—vivid contrast to patches of blue sky amid the cloud-rack—hurrying to lose its identity in the greater Columbia River and ultimately the Pacific. The roar of the tumbling water, the harsh thunder of the exhausts, the rumble of the wheels, all merged into a crescendo of sound magnified by echoes flung back and forth between the jagged walls of dripping fir-clad rock that hemmed us in as "The Dominion" made its determined way up and up towards the snow-capped peaks standing like sentinels across our path, towering into the blue as we began to emerge from the mist-shrouded canyon. The two great engines made no bones of the heavy train; as a rule only 2-3rds regulator and 25 per cent. cut-off were called for until at Albert Canyon, on a 1 in 48 pitch, the air-operated reverse wheel buzzed round briefly and the rod went forward; 35-40 per cent. here, and the exhaust-note deepened. No. 5926 was pulling now, and no mistake! So was 5900, and both firemen chose this stretch to feed tube-cleaning sand through the little inspection hole



The 5900s are magnificent engines, as this picture shows. They are the most powerful in use on the C.P.R.
Photograph by courtesy of the C.P.R.

in the firedoor. It was pulled off the scoop in a flash and sped away through fire-box and flues, to emerge a second or two later above the chimney in a cloud of sooty smoke, 5900 rudely depositing her contribution on top of us. Suddenly the sun broke through the cloud-curtain, and pouring down into the dripping canyon, showed clearly the vast scale on which Nature had worked when building this mighty rampart, and the magnitude of the task the old-time engineers tackled when breaching it half a century ago.

We were in Rogers Pass now, notorious for tremendous snowfall—45 ft. fell one winter—avalanches, rock slides, snowsheds, heavy gradients and assorted engineer's nightmares, which originally made zig-zagging necessary and involved very expensive operation. The destructive power of an avalanche is almost unbelievable—until you see the result of one! Nothing can stand up against the thundering mass of packed snow, rock and uprooted trees when a "slide" comes roaring down from high up a mountain side, gathering weight and momentum at every yard. One on Rogers Pass was measured and timed—it weighed over a million tons, and hit the track at 60 m.p.h.! "The Dominion's" 2,000 man-made tons moving at 25 seem rather paltry in comparison,

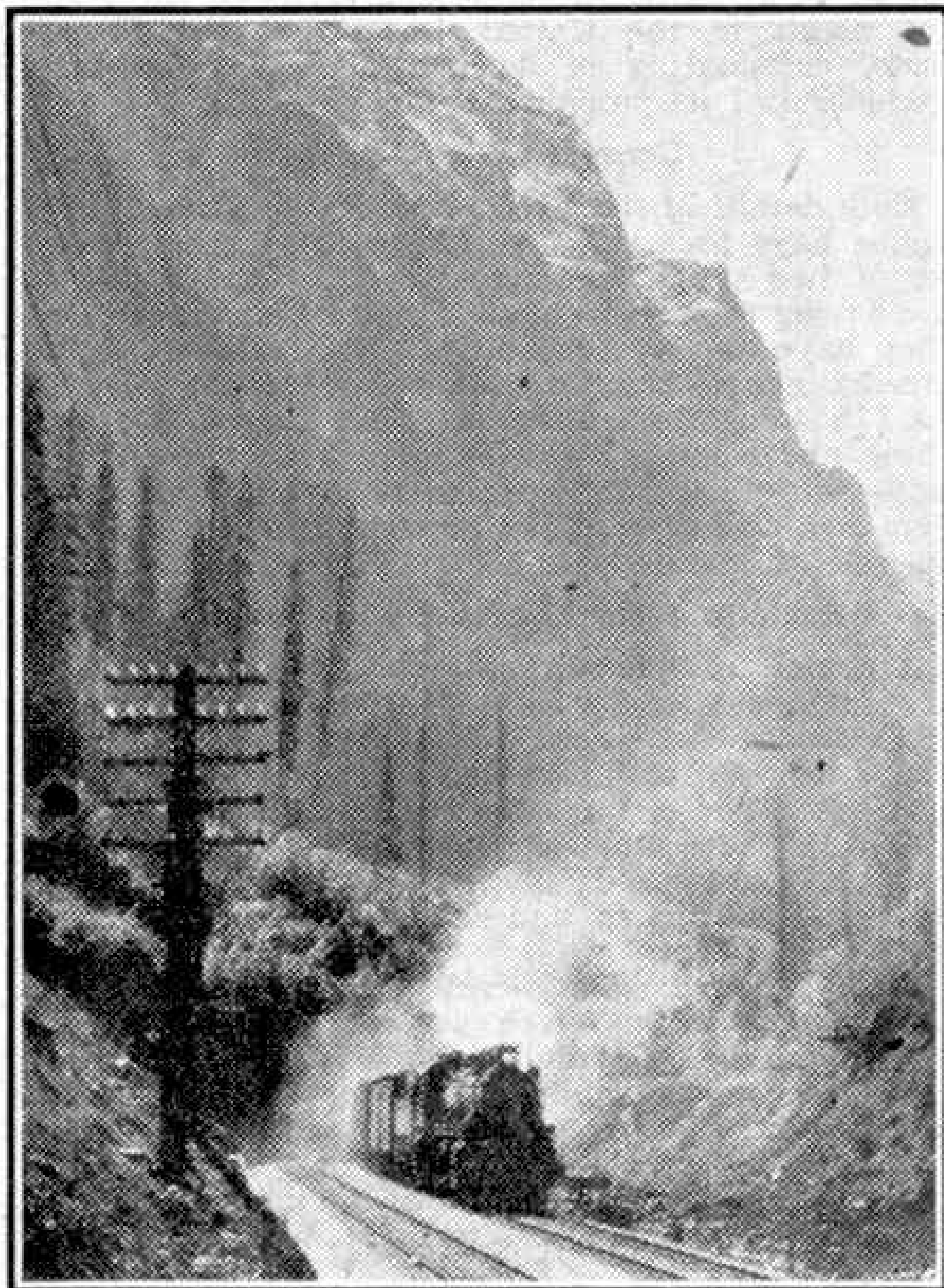
don't they? So if you ever see an avalanche coming for you, stand not upon the order of your going, but *git!* Another Illecillewaet sample swept a rotary plough into the river, killing some of the crew; the remains were pointed out to me by the engineer concerned, with whom I happened to be riding, lying half submerged in the rushing water, mute witness of the tragedy, and of puny Man's helplessness when Nature suddenly runs amok.

We were nearing Laurie tunnel now, and sundry snowsheds; Laurie is a sulphurous little beast that caught me bending the first time I went through in the cab. The fireman told me: "Take a deep breath, hold it until we get through, and cover up your face." Suspecting leg-pulling, I did neither, and had to breathe mid-way, being neatly flaked out by 140 degrees of heat and poisonous sulphur fumes. Laurie is something like Linslade, north of Leighton Buzzard on the L.M.S., another cramped and treacherous little wretch that will betray you if it can. Your ear-drums buckle when you enter it just as they do when you plunge into the Hampstead Tube after the open bit from Golders Green—did you ever notice this? But back to the Laurie; on this occasion 5926 made things all the worse by slipping in the middle—the gradient is steeply upward going east—the atmosphere, already fouled with 5900's tremendous exhaust, becoming almost unbearable. What great gulps of the pure, cool mountain air I swallowed when we burst out into the open and the cab cleared!

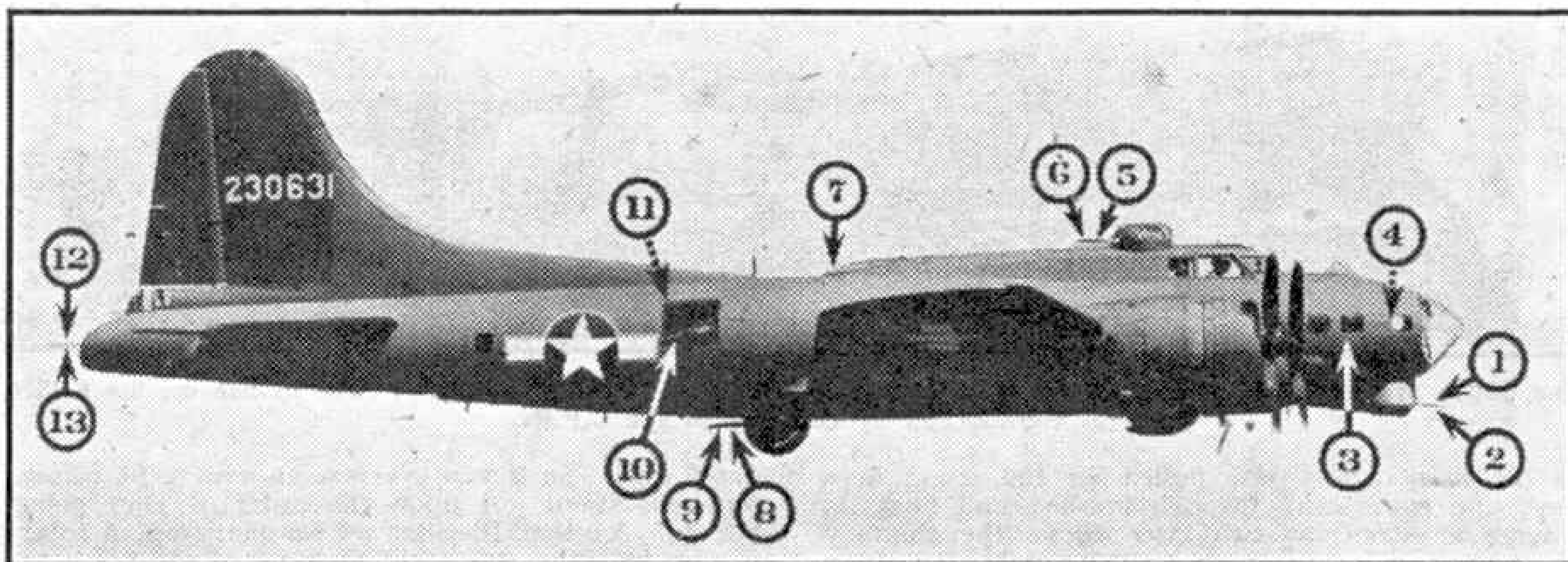
To offset some of the drawbacks of Rogers Pass the famous Connaught tunnel was driven through the Selkirks under Mount Macdonald 25 years ago; it is the longest in Canada, five miles, double tracked, well ventilated by Diesel-driven fans, and dead straight—you can see the pin-point of light at the other end directly you enter, and you reach it in 12 minutes. Trains take the left-hand metals so the driver can better see possible falls of rock from the roof where it is unlined. Glacier station lies just outside the western portal, 3,837 ft. above sea-level at Vancouver; we had climbed 2,284 ft. in the 40 miles from Revelstoke, which had taken 95 minutes, 25 m.p.h. No. 5900 came off here, leaving us to carry on through the tunnel solo, and we emerged at the other end into warm sunny air totally different from the cool, damp snappy atmosphere at the Glacier entrance.

Here a happy thought—why not go out to the front end? The cab is a fine viewpoint, granted, but the cowcatcher, or its vicinity, makes an even better grand-stand seat. So along to the steps beside the smoke-box I clambered, sitting there enthralled, watching the wonderful panorama of mountain, forest and river unfold as 5926 drifted down, down from the heights round curve after curve, over spidery bridges, along narrow shelves cut from precipices, through rock cuttings and brief tunnels into the wide Columbia valley. Speed was moderate, naturally, and the warm breeze fanned softly past, merging with the rhythmic click of rail joints, the sniffing of cylinder vacuum-valves, the periodic song of the injector and other musical engine noises, to form an orchestral accompaniment very soothing to a locomotive enthusiast. The riding was perfect, far better than at the cab end.

(To be continued)



Emerging from the east portal of the Connaught tunnel. Note train is on left-hand metals.



Boeing B-17G "Flying Fortress" heavy bomber, with the new power-operated "chin turret" under the nose. The reference numbers indicate the various guns, and are explained on this page. Photograph by courtesy of the Boeing Aircraft Company, U.S.A.

Air News

The Latest "Flying Fortress"

The great fire power of the Boeing "Flying Fortress" heavy bomber has been further increased by the addition of a power-operated "chin turret" under the nose of the aircraft and equipped with two 0.5 calibre machine guns which have an effective range of about 1,000 yds. This turret, indicated by the numbers 1 and 2 on the photograph at the top of this page, is designed to parry frontal attacks by enemy fighters, and provides very valuable added fire power from the front part of the bomber.

Nos. 3 and 4 on the photograph are manually operated guns and supplement the frontal fire of the chin turret. The two guns in the top turret, indicated by 5 and 6, sweep the skies above the "Fortress," and No. 7, manually operated, is in the radio compartment amidships. Nos. 8 and 9 are ball turret guns which cover the underside approaches to the bomber, and 10 and 11, operated from the waist windows, command lateral approaches to the plane. Bringing up the rear are Nos. 12 and 13, comprising the deadly tail or "stinger" turret of the "Fortress."

Jet-Propelled Fighter Aircraft

The recent official announcement that jet-propelled fighter aircraft will soon be in production for the British and American air forces is a fresh reminder of the unceasing research that goes on behind the scenes to develop new and better aircraft. The news that already hundreds of successful test flights with jet-propelled machines have been carried out in this country and the United States without a single mishap indicates the great progress that has been made in the development of this revolutionary type of aircraft.

Before the war, Britain, Italy, and Germany, were independently carrying out research to develop a satisfactory jet-propelled aircraft, and the Italians produced a machine of this type that in 1942 flew from Milan to Rome at 130 m.p.h. The jet propulsion system, which dispenses with the airscrew, was explained in a special article in the September, 1943, "M.M.," that included a photograph of this Italian machine.

The official announcement reveals that in Great Britain work on the design and production of a jet-propelled engine was begun 11 years ago by Group Capt. F. Whittle, and that his first engine ran successfully in April, 1937. In 1939 the Gloster Aircraft Co. Ltd. received the first order ever given by the Air Ministry for aircraft using jet-propelled

engines, and these engines were built at a special factory by Power Jets Ltd., to whom Group Capt. Whittle was loaned for the job. This machine, Britain's first jet-propelled aircraft, made its first successful flight in May, 1941. A few months later full details were given to General Arnold, Chief of the U.S. Army Air Forces, and at his request one of the engines was sent to the General Electric Co. Ltd., U.S.A.

Close co-operation between the British and U.S. Ministries of Production resulted in several of these engines being constructed in the United States and an order being given to the Bell Aircraft Company for a suitable aircraft.

The first American-built jet-propelled engine was ready for test within six months of the order being given, and the first flight of the Bell machine fitted with this type of engine was made on 1st October, 1942, within a year of work on the machine being put in hand. Afterwards a long series of successful test flights in the United States and Britain was made, culminating in definite plans for the early production of jet-propelled fighter aircraft.

German Glider-Bombs

More details of the German rocket-controlled glider bombs have been released. Apparently these bombs are of two types, weighing 2,500 lb. and 1,500 lb. and having wing spans of 30 ft. and 20 ft. respectively. They have already been used, with little success, on Allied convoys, being carried under the new Heinkel He 178 4-engined bomber and the Dornier Do 217. These glider-bombs, which are rocket-propelled and radio-controlled, are apparently manufactured by Henschel, and each of the bombers can carry two of the smaller bombs.

J. W. R. TAYLOR.

Parachute Troop Operations in New Guinea

A series of photographs recently published in America demonstrates for the first time the technique developed by the U.S.A.A.F. for delivering parachute troops to the required spot with a minimum of casualties. The pictures covered the Markham Valley action in New Guinea, when American parachute troops captured Nadzab aerodrome, helped to bring about the fall of Lae, and cut off the Japs retreating down the Valley.

First "Havocs" flew across the Valley, laying a dense white smoke-screen several hundred feet in depth, and the "Dakota" transports came in behind this screen, out of sight of the enemy. The transports and soldiers were given continuous and powerful air cover by "Lightning" fighters, so that the parachute troops were able to land and form up unobserved, and attack through the smoke-screen.

J. W. R. TAYLOR.

Regular air mail and passenger services are being operated in Iceland by a new company established there.

The Improved "Typhoon"

Since the article on the Hawker "Typhoon," on pages 48-9, was written, it has become known that the latest version of this machine is fitted with a sliding hood that gives the pilot a finer all-round field of vision than from any other single-engined fighter in the world. This improved "Typhoon" is shown in the upper photograph on this page.

Designed by Hawkers and built by Triplex, the sliding hood is moulded from one piece of transparent sheet and is of excellent aerodynamic shape, streamlining being completed by the bulged sides which help to increase the pilot's downward and rearward field of view. It is lighter than the old style cockpit with doors and a fixed head fairing, and has added useful miles-per-hour to the "Tiffy's" speed. Backward and forward movement is controlled by a handle on the port side of the cockpit, a spring-loaded plunger permitting the hood to be locked in any position. In case of emergency it is jettisonable with the starboard top cabin side panel. The new windscreen fitted with the hood is of the "clear-view" type, consisting of three flat bullet-proof glass panels in a duralumin frame so ingeniously designed that forward vision is not normally impeded in the slightest.

J. W. R. TAYLOR.

The "Black Widow"

A new American aircraft just announced is the P-61 twin-engined night fighter, which is said to be a Northrop design. It is called the "Black Widow," after the most deadly spider in the world, and is claimed to be the best of its type now in service. The "Black Widow" is being used by the U.S. Army Air Forces.

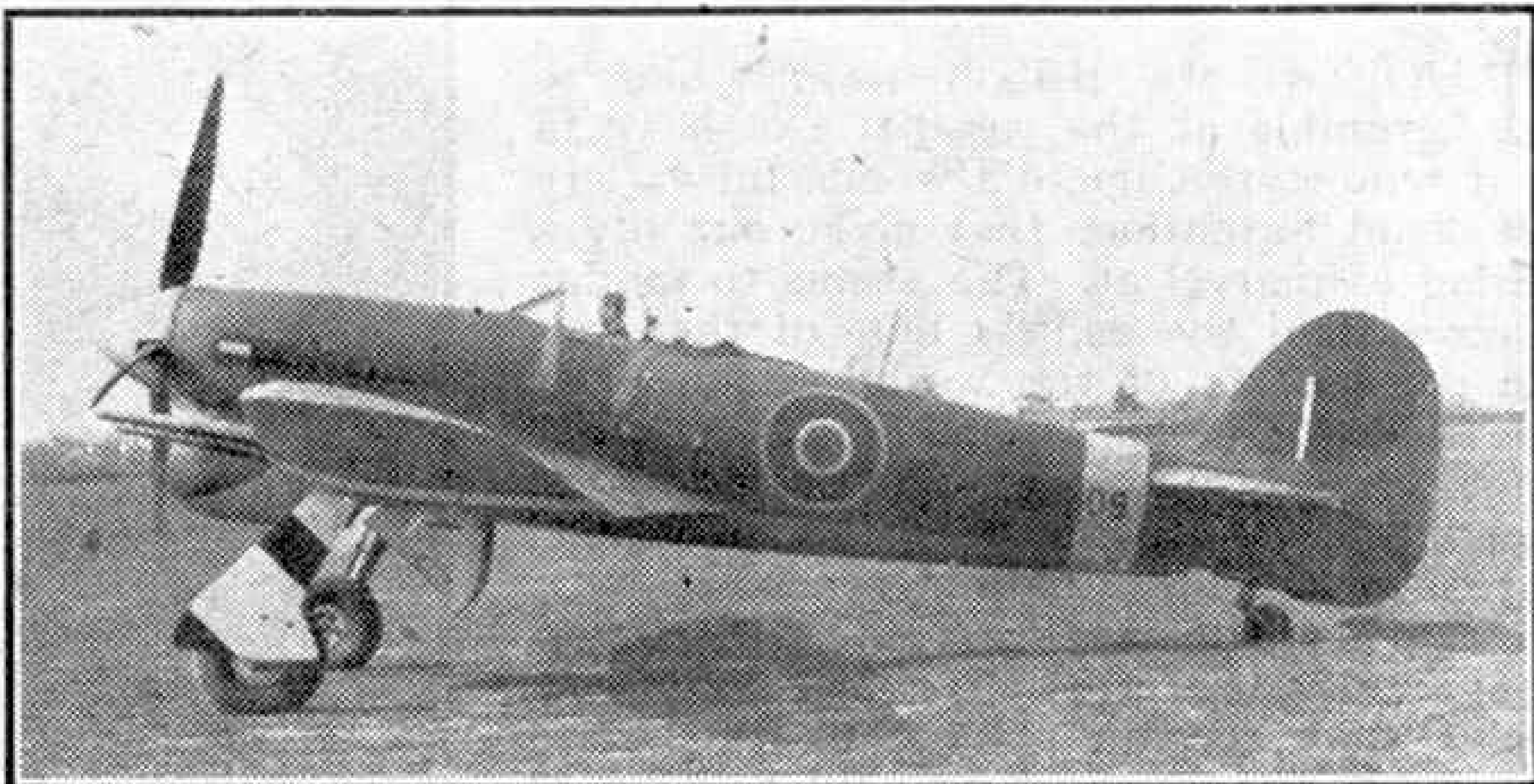
More Powerful "Cyclone" Engine

A new and more powerful version of the well-known Wright "Duplex Cyclone" aero engine is in quantity production, and is being fitted in the big Lockheed C-69 "Constellation" transports now going into

service with the U.S.A.A.F. It develops 2,200 h.p. with either gear-driven or exhaust turbo-supercharger, and its 18 cylinders are mounted in two rows. The engine has an overall diam. of 55 in.

England-Australia Air Route Re-Established

Qantas Empire Airways recently completed a fine job when they re-established the air route between



Hawker "Typhoon" with the new sliding hood. (See paragraph on this page, and special article on page 48). Photograph by courtesy of Hawker Aircraft Ltd.

Great Britain and Australia, cut by the Japanese invasion, by introducing a non-stop trans-ocean air service between Perth, on the coast of Western Australia, and Ceylon. The service involves a flight of more than 3,000 miles. Only a very limited number of passengers and a small amount of mail can be carried per trip owing to the big load of fuel required for such a long flight. The Company plan to extend shortly the service from Ceylon to Karachi.

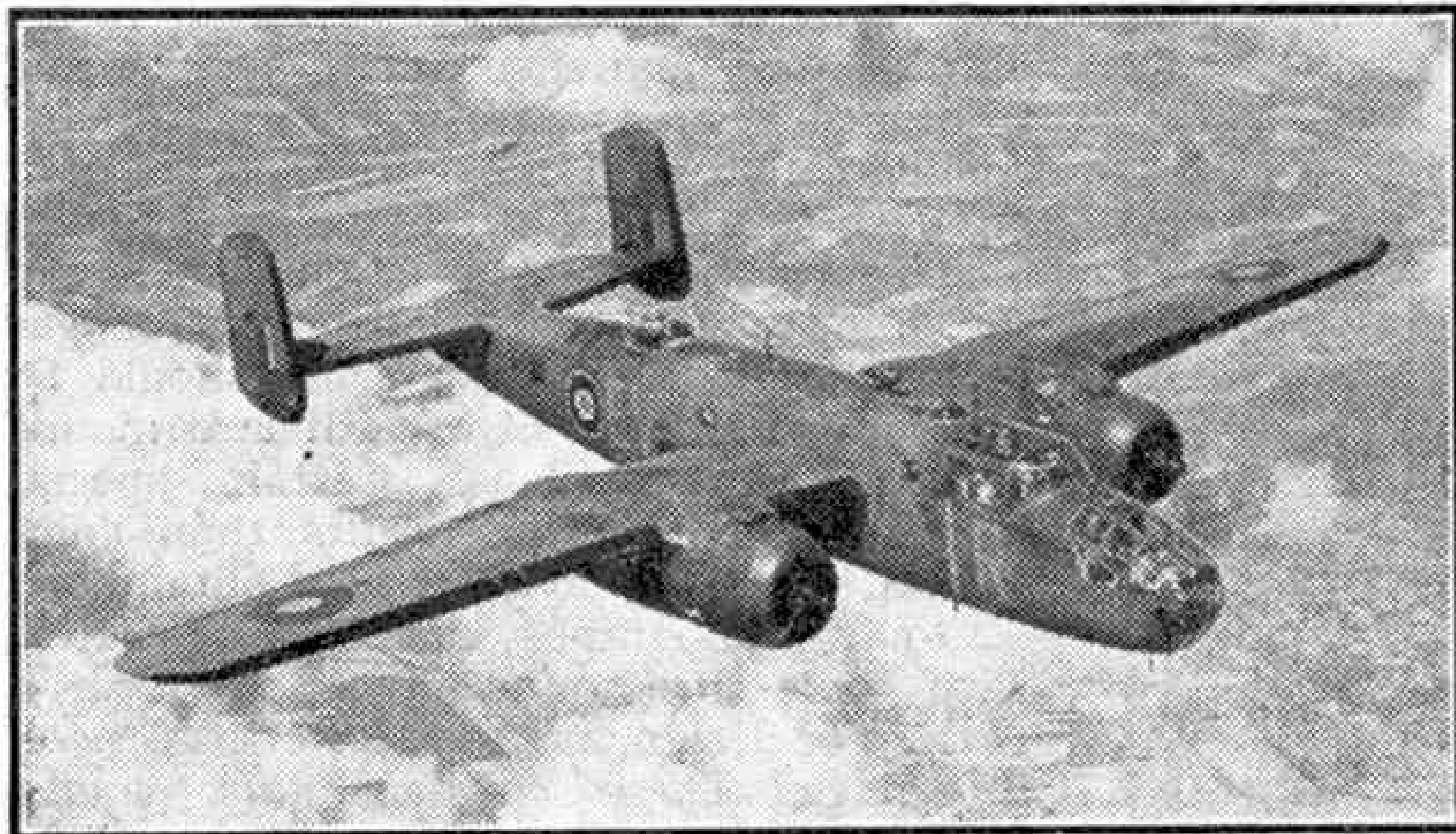
D.H. "Mosquito" Variations

Several new marks of the D.H. "Mosquito" have been announced, including a night fighter version of the Mark II, with "Merlin" XXI engines, that has already achieved notable successes against nocturnal Luftwaffe visitors. Another version (mark number unspecified) carries an armament of four machine guns and four cannon, and an internally-stowed bomb load of 1,000 lb. for high-speed daylight sorties. Long-range fuel tanks are carried outboard of the engines and, presumably, could be exchanged for still more bombs for short-range operations. A third

"Mosquito" type, used for photographic reconnaissance duties, has re-designed engine cowlings to provide additional cooling of the power-unit accessories. The mark number of the "improved" "Merlins" of these P.R.U. "Mosquitoes" is not revealed.

The Packard-built equivalent of the "Merlin" 61, which according to the Germans develops between 1,600 h.p. and 1,800 h.p., is now being fitted to Canadian-built "Mosquitoes" and should considerably increase performance, especially at height. These machines are being flown across the Atlantic to Britain, and since December last have taken part in sorties over Western Europe. Many others produced in Canada have been delivered to the Royal Canadian Air Force.

J. W. R. TAYLOR.



An R.A.F. North American "Mitchell" bomber, one of the types of aircraft which have been carrying out daylight raids on military objectives in the Pas-de-Calais area of France. Photograph "The Aeroplane" Copyright.

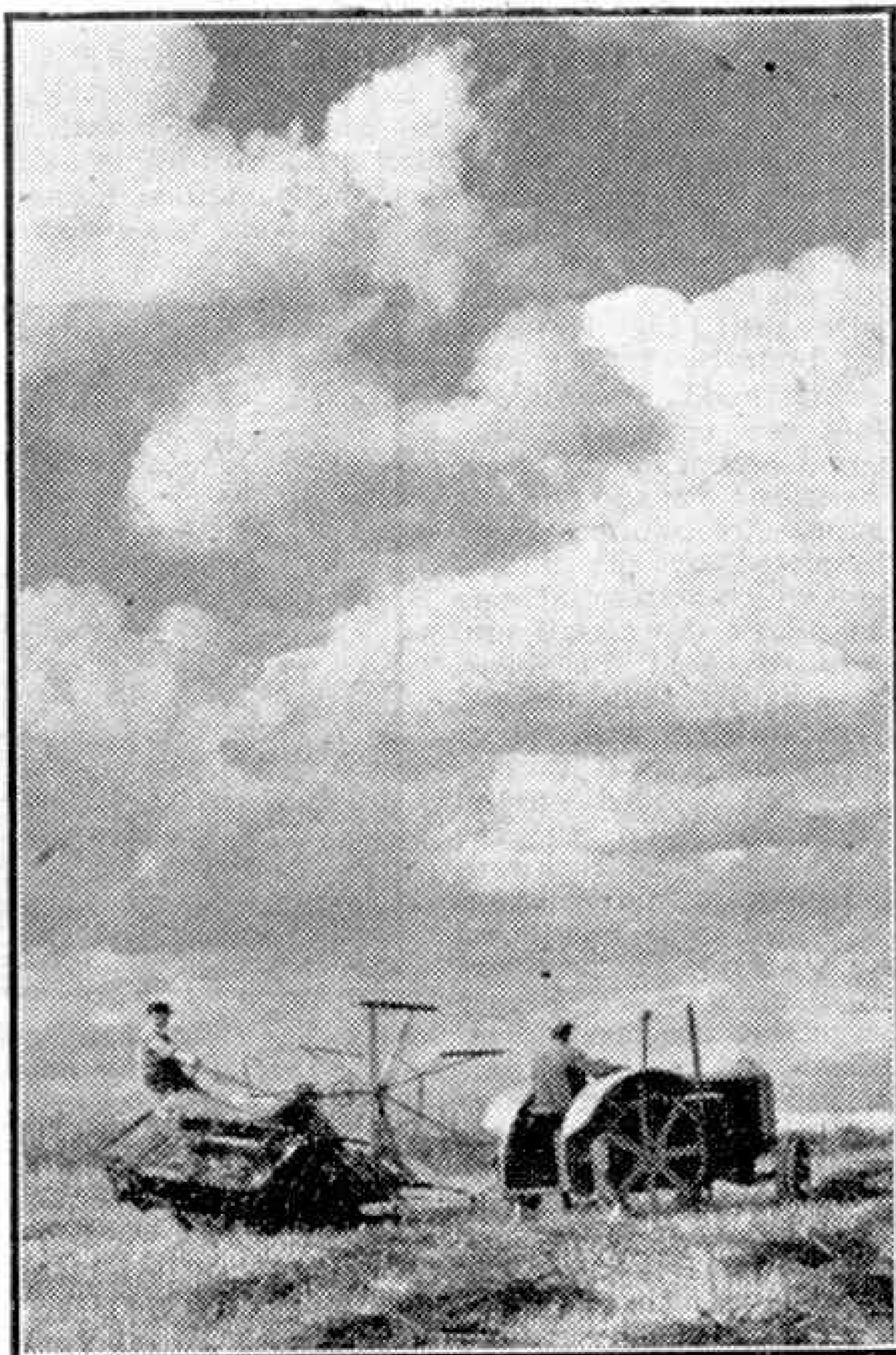
Photography

Picture Making with Clouds

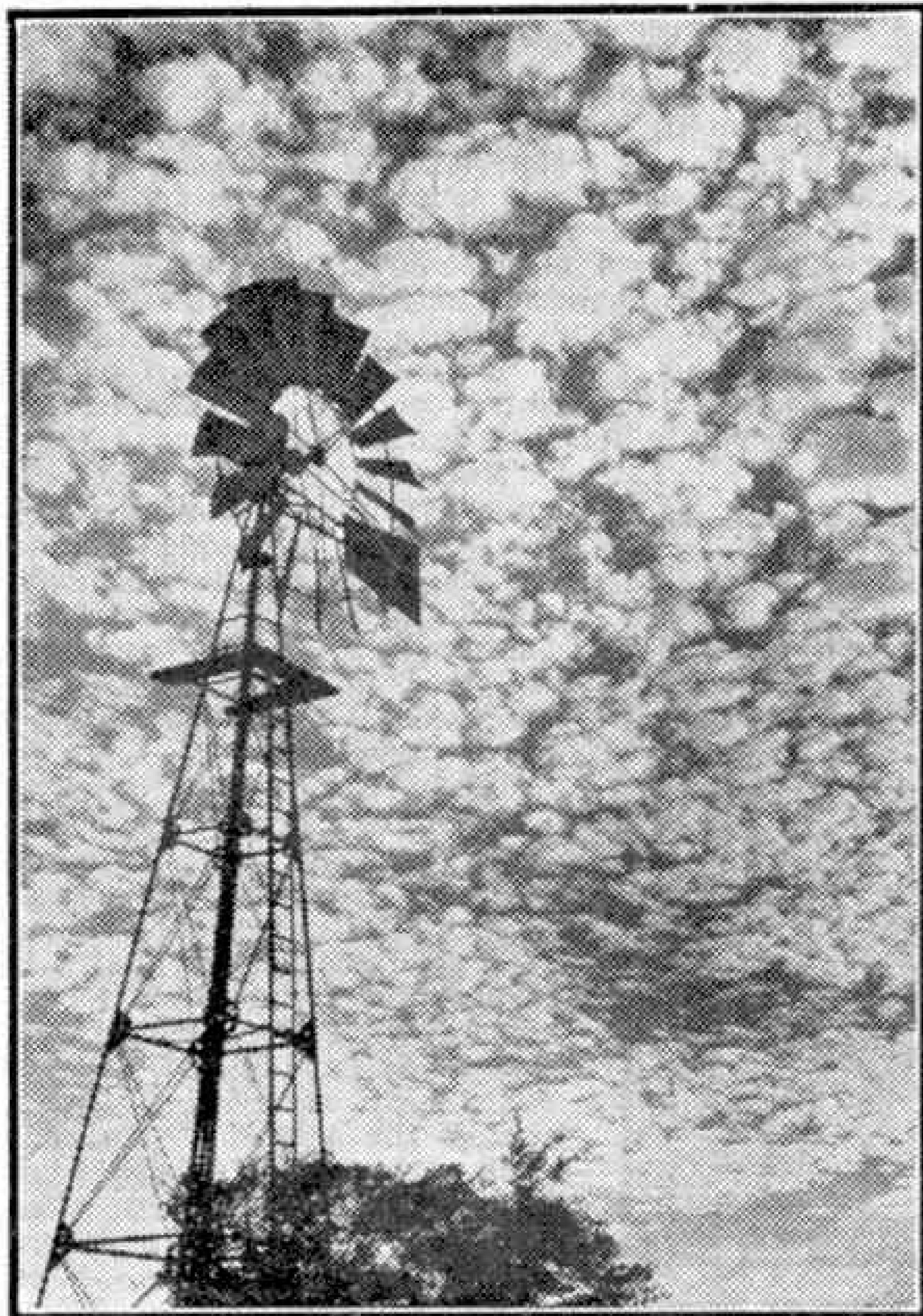
By E. E. Steele

THOUGH we British people like to grumble at the weather, we have in our temperate climate a wonderful variety of cloud formations that make our sky a thing to marvel at. This seems to me far better than the endless blue of the skies in some parts of the world, which must be dreadfully monotonous, and certainly not very inspiring to photographers to whom the changing skies in our islands are a great help in outdoor work.

When friends look through my album of prints they usually remark about the ones that contain clouds, as though it required some marvellous skill to capture the beauties of the skies. Actually it is quite simple. With modern colour-sensitive material it is easy for a beginner to get a good rendering of clouds with any type of camera, if he uses a filter. A yellow one is very suitable, of a depth that increases the exposure two or three times with orthochromatic films, and about half



Harvest field. A picture that would have been nothing without the sky.



Cirro cumulus clouds at evening.

as much with panchromatic films.

In peacetime such filters in a variety of fittings were readily available. They are scarce to-day, however, and readers who do not possess a filter may have to do the best they can with a home-made type. To make a yellow filter, take a piece of photographic film, fix it thoroughly in plain hypo of a strength of about four ounces to the pint of water, wash it for half an hour, and then dry in a place free from dust. The dye consists of an ordinary commercial dye of the "Jiffy" type, of a strength to produce a light yellow. Filters of deeper yellow can be made by keeping the film in the dye solution for longer periods. The filter thus made should be fitted in some kind of a cardboard mount to go over the lens. Certain special chemicals give better results than commercial dyes, but are not now obtainable.

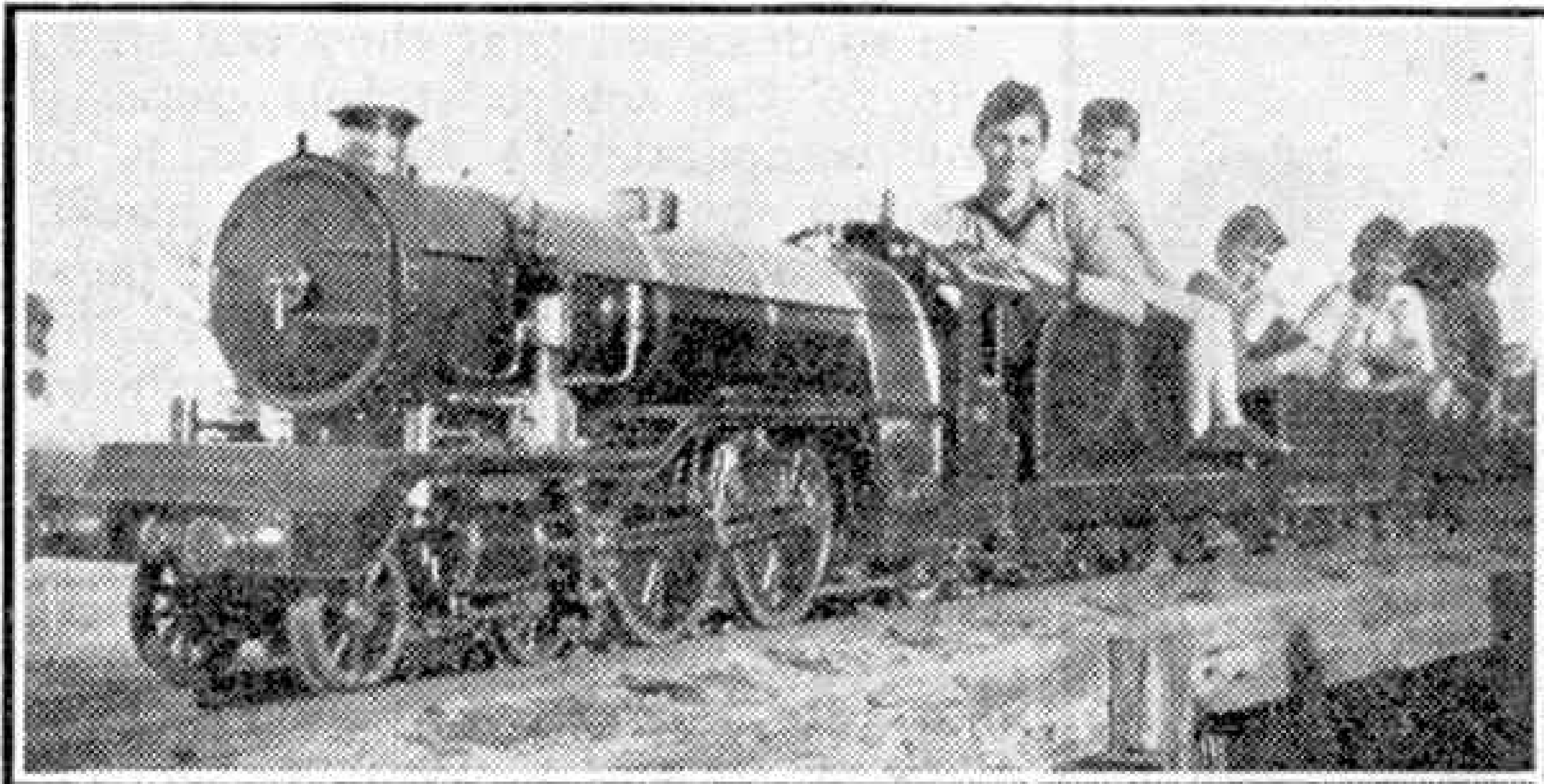
Cloud photographs usually look better with some foreground object to form a pattern or design, as in the lower picture on this page. These *cirro cumulus* clouds, familiarly known as "mackerel" sky, make a most beautiful cloud formation to photograph, especially in the evening.

From Our Readers

This page is reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

AN AUSTRALIAN MODEL LOCOMOTIVE

The engine shown in the accompanying photograph was built by Mr. N. Fullard of Pyalong, Victoria. Its scale is 2 in. to 1 ft., and the driving wheels are 1 ft. high. The engine works at a pressure of 100 lb. per sq. in. and has a steel boiler. The steam pump



This splendid model steam locomotive was built by Mr. N. Fullard, Victoria, Australia, who also built the track on which it runs. Photograph by R. K. Downing, Melbourne.

at the front pumps water continuously from the tender to the boiler. There is a powerful steam brake and everything is controlled from the cab.

The engine is painted gold and red. It has reverse gear and weighs a ton. The rails on which it runs are laid at Mr. Fullard's farm, and along them it is capable of 30 m.p.h. There are several coaches, all well sprung, which have carried a total load of over 70 stone. The construction of the track and of the engine have been Mr. Fullard's hobby and with them he has been instrumental in raising much money for the Red Cross. R. K. DOWNING (Melbourne).

BRITAIN'S FINEST ROMAN ROAD

As the result of recent news bulletins from the Italian battle-front, most of us have learned something of the Appian Way, the greatest of Roman roads, which runs from Rome to Brindisi, but few are aware that the finest Roman road remaining in Western Europe is to be found crossing the high moors of Blackstone Edge, on the border of Lancashire and Yorkshire. This ancient highway, almost 2,000 years old, branches off from the modern Blackstone Edge road at the "White House," near Littleborough, and climbs over the wild moorlands of the Pennines, which incidentally is a name of Roman origin, derived from that of the Apennines in Italy. It rejoins the modern highway at Bailings Gate, on the Halifax side of the Edge.

The old Roman way, which can be followed for its entire length, is still paved with the original gritstone blocks, laid by the legions. Its width is about 15 ft. and the chief feature of the road is a central trough of masoned stones, about 2 ft. across, the purpose of which has not yet been discovered. Drainage has been suggested, but probably the deep groove was specially cut for braking purposes. A faggot-brake, consisting of a large bundle of bound sticks, was trailed behind the Roman baggage waggons or chariots in the central trough, when on the down grade. A small stone bridge is also to be seen, as is the paved

courtyard of a stage-house, or military post, the building of which has long since vanished.

In Roman times this old road was the main route between Mancunium, or Manchester, and Eboracum, or York, and even as late as the early 18th century it was the only practical road over that part of the Pennines. Daniel Defoe, the author of "*Robinson Crusoe*," crossed it on his way to Halifax. CYRIL R. ROWSON

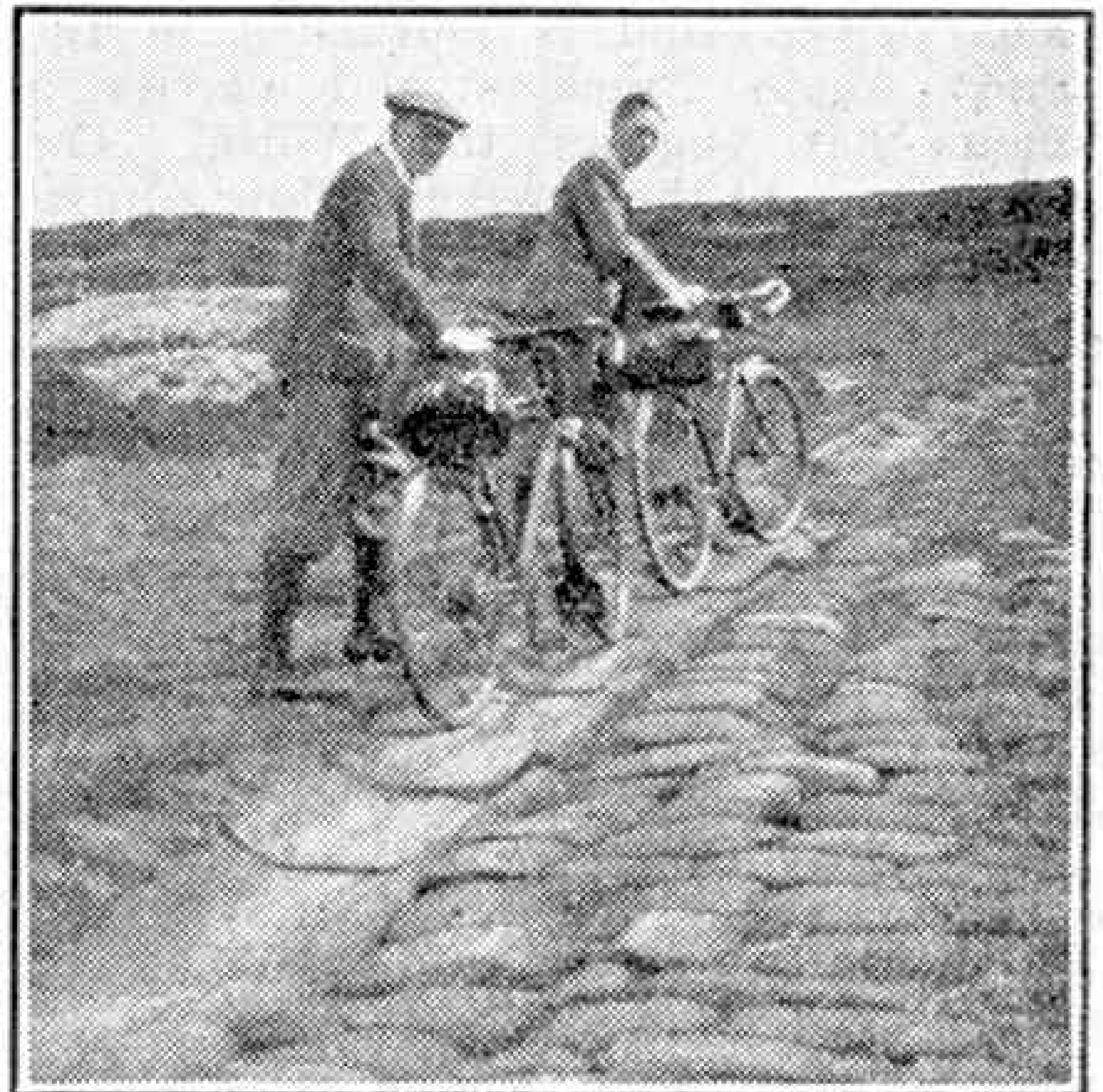
(Liverpool 11).

A DANISH LIFT BRIDGE

During an air raid by the R.A.F. on Messrs. Burmeister and Wain's engineering works in Copenhagen, the well-known "Knippelsbro" bridge was damaged. There was a bridge of sorts on this site in 1857, connecting the city and its suburb Christianshavn, on the island of Amager, and it was followed by a bascule bridge for which Mr. Wain, of Messrs. Burmeister and Wain, whose works are near by, personally made all calculations and drawings.

Later another bridge was built, and finally in December, 1937, the fourth and latest bridge was erected. This is a very fine rolling lift structure. It opens to admit the passage of shipping, and from the time when the alarm bells ring, and red warning lights flash the danger signal to the oncoming traffic, to that when the two halves of the bridge have been raised through some 60 degrees, is only 5 seconds. I have timed it with a stop-watch. On each of the two piers that carry the hinges of the moving parts of the bridge is an oval tower some 50 ft. high, with observation platform and control gear, and a nautical touch is lent by portholes.

D. E. REBBECK (Belfast).



A road 2,000 years old. It was built by the Romans and crosses Blackstone Edge, in the Pennines. Photograph by C. R. Rowson, Liverpool.

Suggestions Section

By "Spanner"

(631) A Worm Drive Unit for Small Vehicles ("Spanner")

The simple and neat mechanism shown in Fig. 631 is a compact rear axle drive unit, which is intended chiefly for use in small models of motor cars. It is constructed as follows. Two Corner Angle Brackets 1 are fixed by their elongated

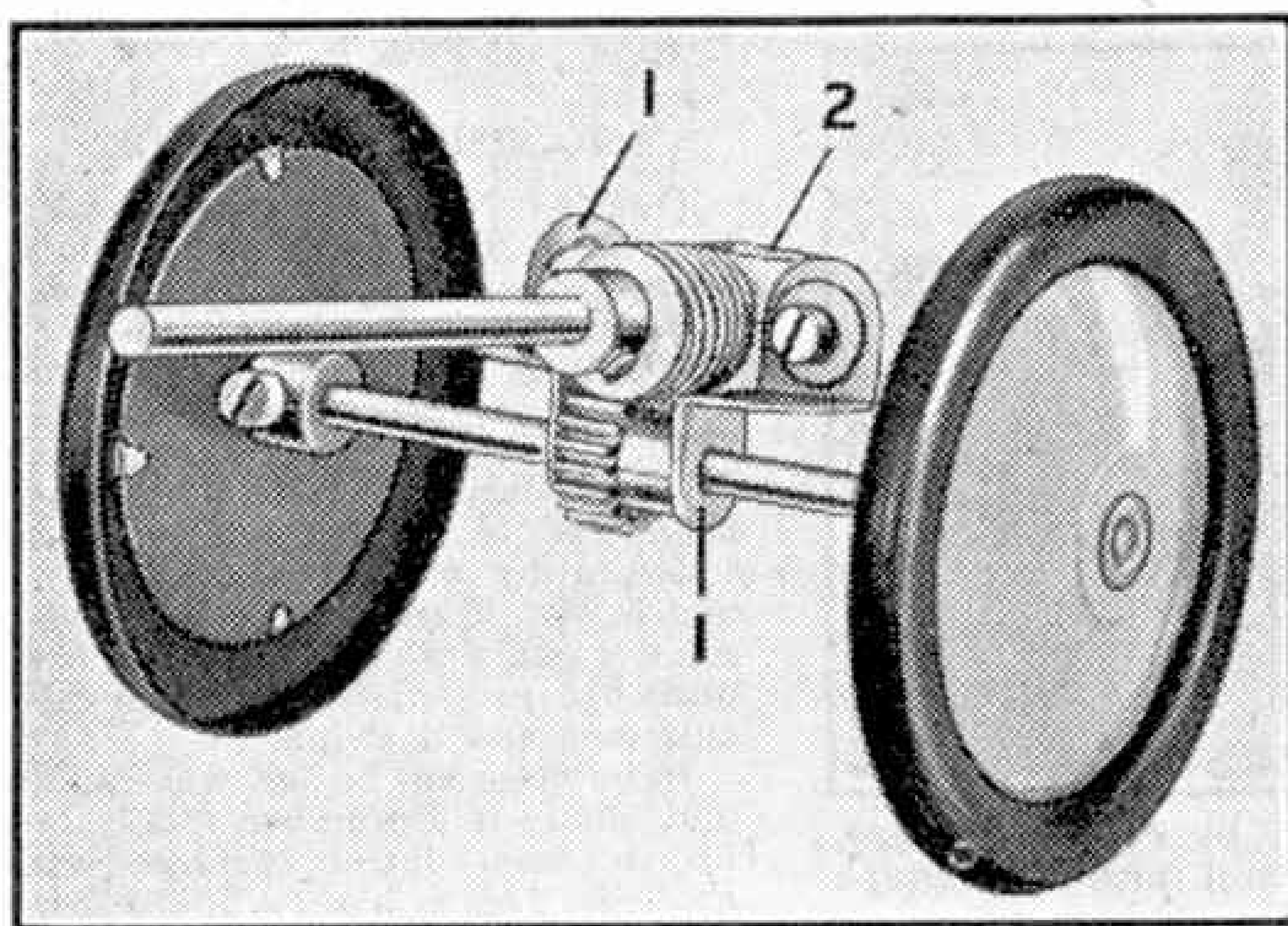


Fig. 631

holes to a $1\frac{1}{2}$ " Strip that in turn is bolted to a Double Bent Strip 2. A Rod carrying a Worm is passed through the centre holes of the Strip and the Double Bent Strip, and is held in place by a Collar, a Washer being placed between the Worm and the Strip for spacing purposes.

The driven Rod is journalled in the Corner Angle Brackets and carries a Pinion that engages the Worm. The slotted holes of the Brackets allow adjustment to be made so that either a $\frac{1}{2}$ " or a $\frac{3}{4}$ " Pinion can be arranged to mesh with the Worm.

When this mechanism is used in a motor vehicle it is not possible to include a differential in the rear axle, and in view of this one of the road wheels should be free on the axle to allow for the difference in the speeds of the two wheels when cornering.

This mechanism can be put to other uses than that described here, for it forms a neat and compact gear giving a ratio of 25 to 1 when a $\frac{3}{4}$ " Pinion is used. Thus by building up an additional ratio of 4 to 1, which

can be obtained by means of two $\frac{3}{4}$ " Pinions and two 50-teeth gears, it is possible to obtain a total ratio of 100 to 1.

(632) Semi-Elliptic Spring for Model Vehicles

The method of springing the wheels and chassis is a very important consideration in the construction of any actual motor vehicle. The springs must be so designed that they will stand up to the severe strains imposed by comparatively heavy loads or violent shocks as the vehicle travels over uneven ground, and yet must be so sensitive that they will absorb lesser vibrations. The spring shown in Fig. 632 is a faithful reproduction in Meccano of the type used in many real vehicles. It is what is known as a semi-elliptic spring, and consists of one $5\frac{1}{2}$ ", one $4\frac{1}{2}$ ", one $3\frac{1}{2}$ ", one $2\frac{1}{2}$ " and one $1\frac{1}{2}$ " Strip placed upon each other and slightly bent as shown.

Each end of the $5\frac{1}{2}$ " Strip is secured to a Double Bracket. The rear Double Bracket is bolted pivotally to a pair of Flat Brackets that form shackles by means of which the rear ends of the Springs are attached pivotally to the frame of the chassis. The front Double Bracket is mounted on a $\frac{3}{4}$ " Bolt passing through the side frame members.

There are several other types of springs that are widely used on modern vehicles and some of these will be described and illustrated in "Suggestions Section" pages of future issues.

(633) Simple Built-up Crankshaft ("Spanner")

In an engine where an ordinary type of balanced crankshaft is required an

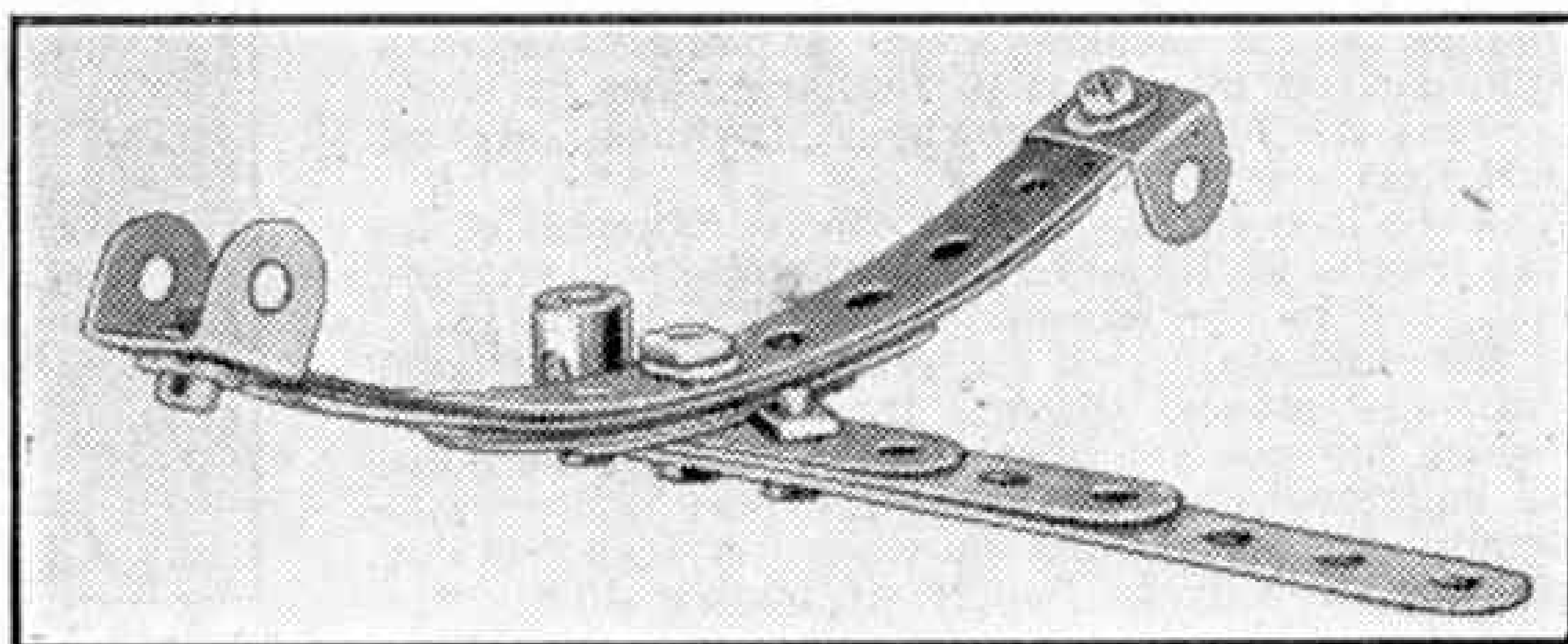


Fig. 632

arrangement similar to that shown in Fig. 633 will be found very suitable.

Each crank is built up from a Triangular Plate fitted with two Cranks, one of which has its boss in the centre of one side of the Plate, the other having its boss at the apex of the Plate on the inside. When the two webs are completed they are joined together by a 1" Rod forming the crank pin, on which is carried a Coupling. The crank pin passes through the end transverse boss of this Coupling. The end vertical tapped hole is fitted with a Handrail Support representing a grease box, and the shank of this is fitted with three Washers to prevent it from gripping the Rod.

On one side of the crank is a short Rod forming part of the crankshaft, the part on the other side consisting of a considerably longer Rod carrying a Triple-Throw Eccentric and a 1" Sprocket Wheel. The Sprocket forms a connection between the crankshaft and the governor. The Eccentric, which is set at 100 deg. to the crank, is connected either direct to the valve, or in more complicated models, to the valve gear. The connecting Rod, joining the crank with the piston rod, consists of a Rod of any suitable length.

(634) A Useful Free Wheel Device

(M. Tolworth, Bradford)

Nowadays, when the war has made Meccano Parts difficult to obtain, model-builders will find it useful to know alternative methods of representing special mechanisms when the most suitable Meccano Parts are not at their disposal. For example, a free wheel mechanism is often required, and normally this would be built up with a Ratchet Wheel and a Pawl. If these parts are not available, however, it is still possible to assemble a very satisfactory free-wheel device on the lines illustrated in Fig. 634.

In this mechanism a $\frac{3}{4}$ " Pinion is used as a substitute for a Ratchet Wheel, and two Spring Clips take the place of a Pawl. The Pinion is fixed on the driving shaft against the face of a $2\frac{1}{2}$ " Gear Wheel loose on the shaft, and the Spring Clips are held on Bolts locked in the $2\frac{1}{2}$ " Gear as shown. The Clips must be arranged on the Bolts in such a manner that one lug of each Clip engages the teeth of the Pinion and

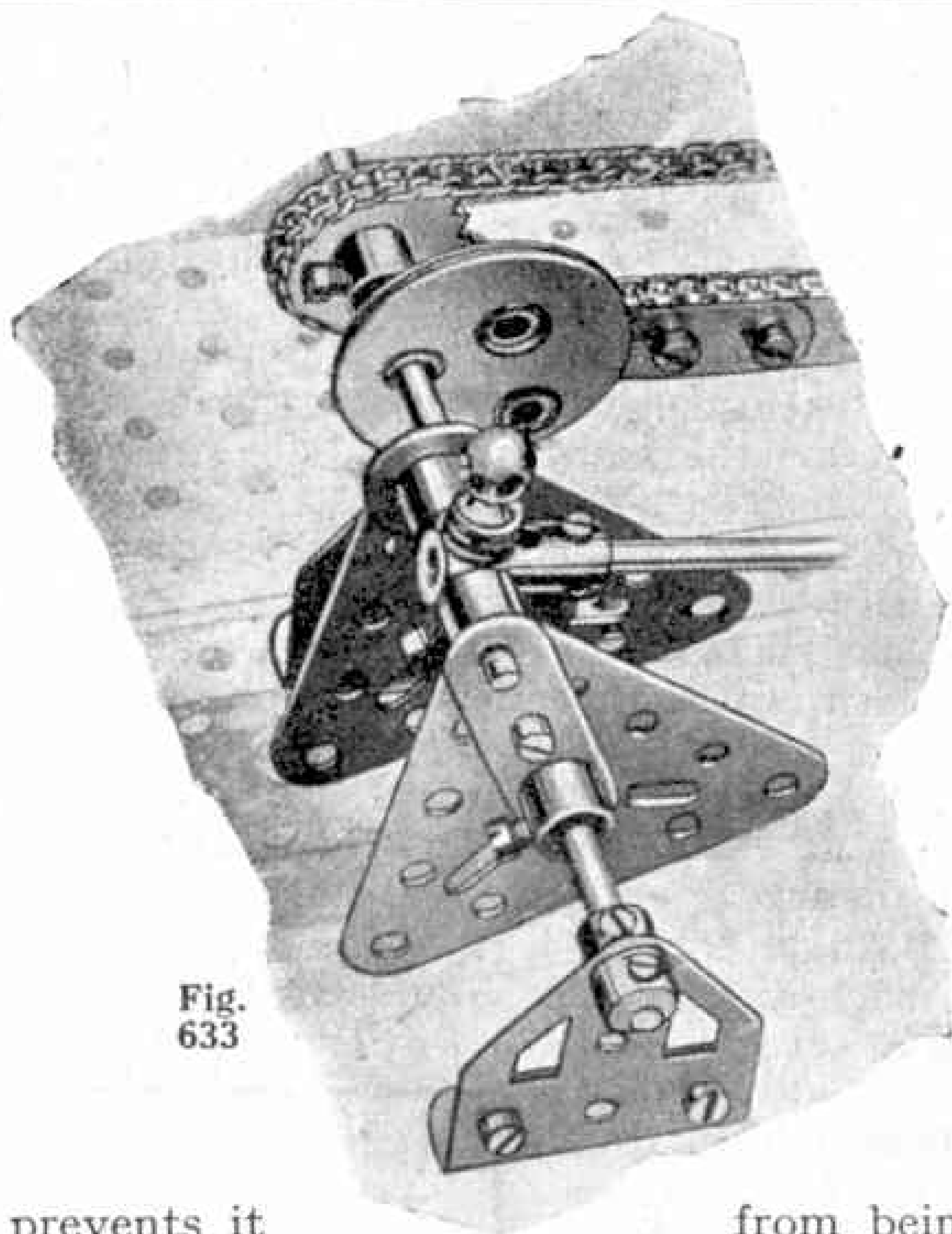


Fig. 633

prevents it from being rotated except in one direction.

(635) Tweezers made from Meccano Strips

Every model-builder should possess a pair of tweezers. This simple accessory has many useful applications in model-building, among them being that of holding Nuts and placing them on Bolts in parts of a model that are out of reach of even the smallest and slimmest fingers.

Tweezers can be made quite easily from Meccano Parts and one method of forming them is as follows. Two $5\frac{1}{2}$ " Strips are bolted together very rigidly through the holes at one of their ends, two Bolts being used for this purpose. The Strips are then bent slightly so that the spring of the metal causes them to remain apart slightly until pressure is applied by the fingers.

The tweezers will be found useful for picking up small parts from an assortment of pieces. Photographers also will be able to find applications for them in the dark room. For example, they can be used for removing prints from one solution to another during development and fixing.

We have no doubt that many readers will find novel and practical uses for the tweezers, and we shall be interested to hear of these.

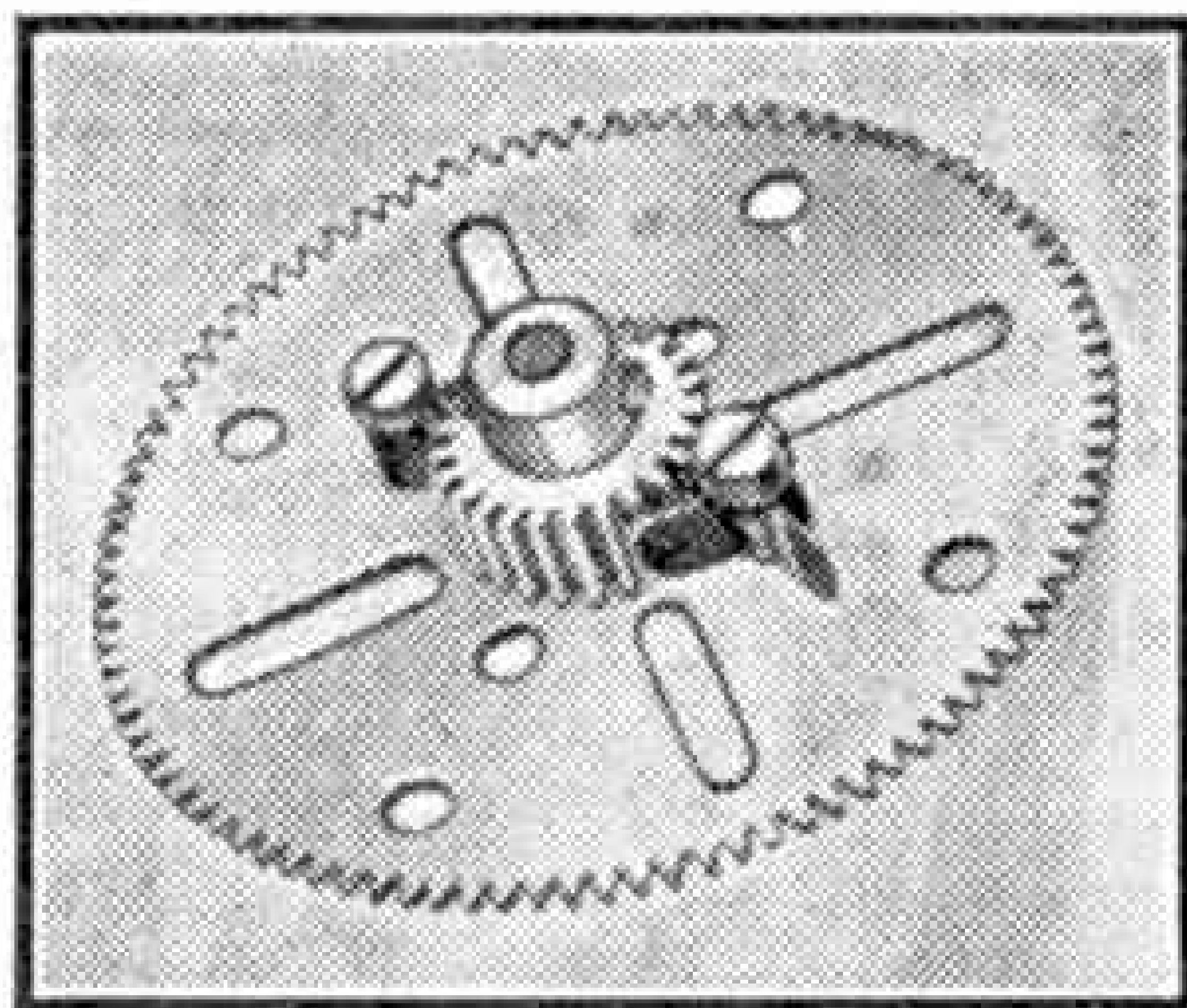


Fig. 634

New Meccano Model

Motor Lawn Roller

THE new model we are describing this month is the fine motor lawn roller shown in the accompanying illustrations. It is driven by a *Magic Motor*, and although quite simple in construction, is sturdy and realistic in appearance.

Construction of the model is commenced with the chassis, each side of which consists of a 3" Angle Girder 1, Fig. 1, the two Girders being spaced apart at their front ends by a 2½" Strip. At their rear ends they are attached to a 2½" Angle Girder 2. A 4½" Strip is fixed at each side to the Angle Girders 1 and these are joined by two 3" Formed Slotted Strips, which are attached to them by a Flat Bracket and 1" Corner Brackets. The front formed Slotted Strip provides a bearing for the steering column, and is reinforced by a ½" Reversed Angle Bracket bolted to the rear Formed Slotted Strip.

The steering column is a 1½" Bolt fixed to two 3" Formed Slotted Strips, which are attached at their front and rear ends to a cage built up from two 2½" × 1" Double Angle Strips bolted at each side to 2½" Strips. The front axle is journalled in the centre holes of the Strips. This is 3" long and carries two Road Wheels, in the grooves of which a roller formed from a 5½" × 1½" and a 2½" × 1½" Flexible Plate is gripped. The front axle unit is completed by attaching a tiller type steering control, consisting of a 3½" Crank Handle fixed at its front end in a Coupling lock-nutted to the upper end of the steering column.

A *Magic Motor* is bolted to the underside of the Girders 1, and is connected to the model as follows. A 2½" Driving Band is passed around the driving Pulley of the Motor and also round a ½" Fixed Pulley mounted on 3" Rod 3, Fig. 2, which is journalled in 2½" Curved Strips

bolted to the Girders 1. This Rod is connected by two 6" Driving Bands, one of which is crossed, to two 2" Pulleys 4 mounted loosely on the rear axle. The latter is a 5½" Rod and is journalled in 2½" Strips fixed at each end to Double Brackets braced by a 2½" Double Angle Strip. The front Double Bracket is then bolted to the Angle Girder 2, together with a Flat Trunnion forming the driver's seat. The Flexible Plate is curved round and attached to the rear Double Bracket.

The Pulleys 4 are fitted with Bolts in their outer holes and these engage

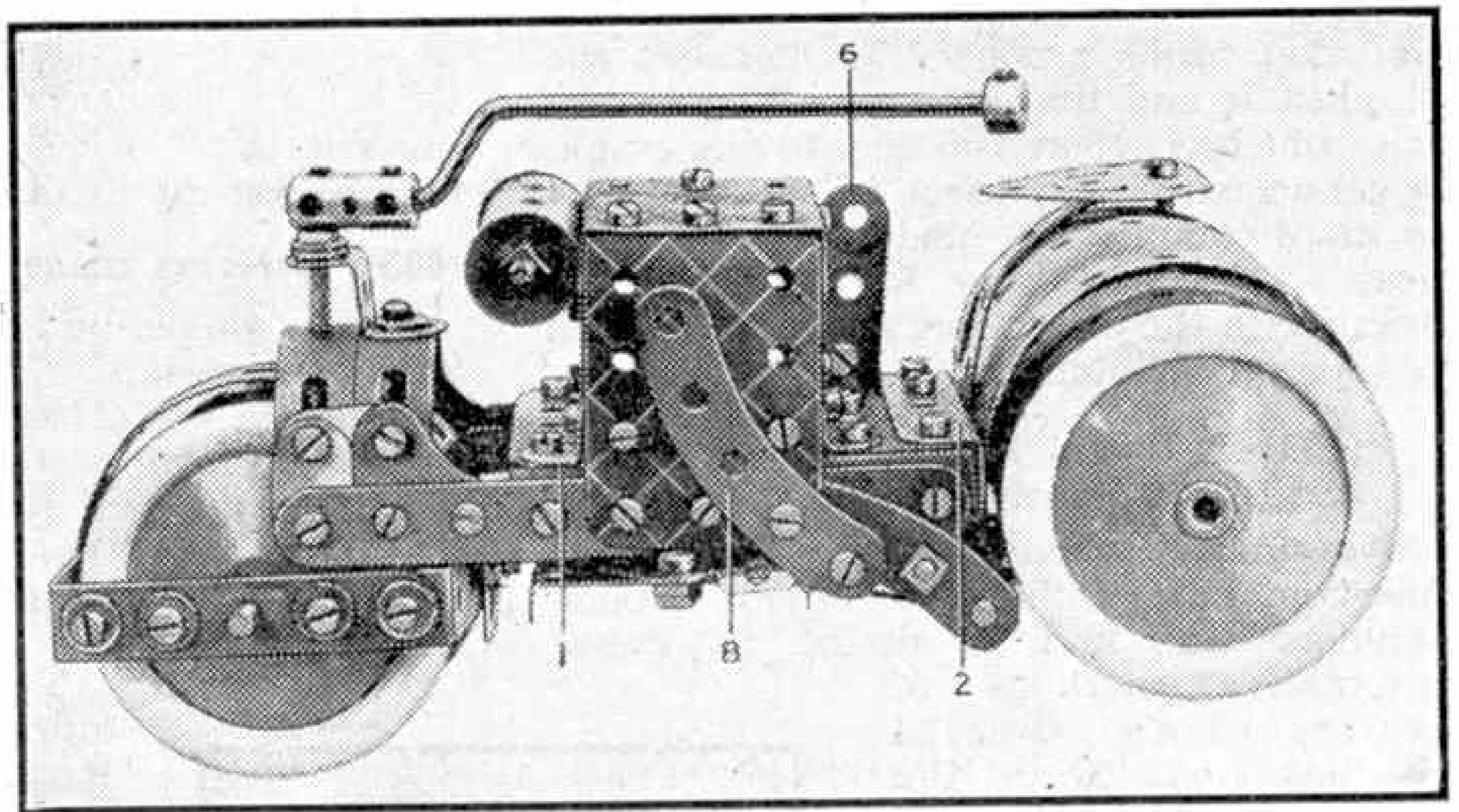


Fig. 1. A fine model lawn roller that is easy to build and ingenious in operation.

corresponding holes in two Face Plates 5, which are spaced from two Road Wheels by 5½" × 1½" and 2½" × 1½" Flexible Plates that form the rear rollers. A small portion of a Compression Spring is mounted on the rear axle between the 2" Pulleys and the Face Plates.

Each of the 2" Pulleys is engaged with its corresponding Face Plate by means of a lever 6, Fig. 1, consisting of a 2½" Strip pivotally attached to the right-hand Girder 1 by a ½" × ½" Angle Bracket. This is connected at its lower end by a further lock-nutted Angle Bracket to a 2" Strip 7, Fig. 2, which is pivoted at its rear end to a bell crank formed from two Flat Brackets. The latter are lock-nutted to a 1" × ½" Angle Bracket bolted to one of the 2½" Strips forming the bearings for the rear axle, and are attached by their other arms to a Collar fixed on a 1"

Screwed Rod, to the ends of which are fixed two Flat Brackets. These are mounted on the rear axle and engage the bosses of the two Pulleys 4. Thus by moving lever 6 backward and forward either of the 2" Pulleys is engaged with its Face Plate, the drive being led to them either by the direct or the crossed driving band.

The dummy engine consists of three $2\frac{1}{2}" \times 1\frac{1}{2}"$ Flexible Plates bent to the shape shown and attached to the petrol tank, which consists of a Sleeve Piece with $\frac{3}{4}"$ Discs fixed at its ends, by means of a 2" Screwed Rod. The radiator is formed from three $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips bolted to the engine casing. The brake lever 8 is a $2\frac{1}{2}"$ Curved Strip lock-nutted to the left-hand Girder 1 and attached to a Collar, in the tapped bore of which is fixed a Threaded Pin. The Pin is inserted in a Rod and Strip Connector lock-nutted to the brake lever of the Motor.

Parts required to build model Light Motor Roller: 2 of No. 2a; 1 of No. 4; 6 of No. 5; 1 of No. 6; 2 of No. 9c; 1 of No. 9d; 8 of No. 10; 2 of No. 11; 8 of No. 12; 1 of No. 12b; 1 of No. 15; 2 of No. 16b; 1 of No. 19a; 2 of No. 20a; 1 of No. 23; 95 of No. 37a; 88 of No. 38b; 28 of No. 38; 2 of No. 46; 3 of No. 48; 1 of No. 48a; 9 of No. 59; 1 of No. 63; 1 of No. 80c; 1 of No. 81; 1 of No. 82; 3 of No. 90; 1 of No. 103a; 2 of No. 109; 1 of No. 111a; 1 of No. 111c; 1 of No. 111d; 1 of No. 115; 1 of No. 120b; 1 of No. 125; 1 of No. 126a; 2 of No. 133a; 1 of No. 163; 1 of No. 186; 2 of No. 186a; 4 of No. 187; 6 of No. 188; 3 of No. 189; 1 of No. 191; 1 of No. 212; 4 of No. 215; 2 of No. 217b; 1 Magic Motor.

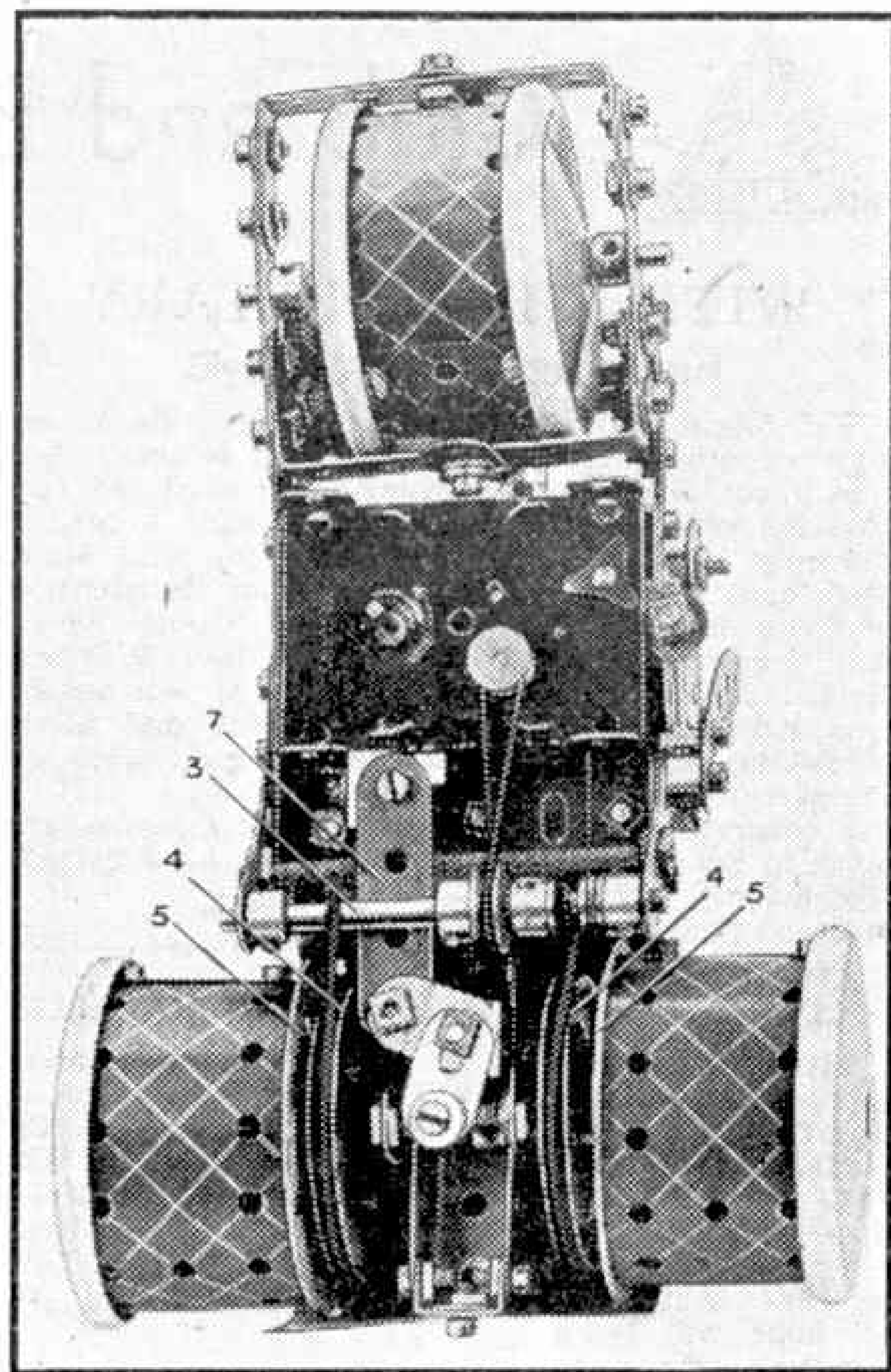


Fig. 2. Under view of the model roller.

Our New Year Model-Building Contest

By "Spanner"

There is still time to plan and build entries in this splendid contest, in which handsome cash prizes are offered. The competition is open to experienced model-builders and also to beginners, a special section for the latter being included, so that everyone has a splendid chance of winning one of the cheques or Postal Orders that are offered.

Full details were given in the January issue, but we repeat them here. No restriction whatever is placed on the subjects of models submitted in this competition. These may be cranes, motor cars or lorries, machines with ingenious mechanisms, or simple structures of an architectural kind, with no movement at all. Although full credit will be given to large and complicated models, it must be emphasised that these are not at all essential. What the judges will look for is skill in design and in the use of Meccano Parts, and soundness in construction. If desired a group of models may be submitted, but they will be regarded as a single entry.

The model itself is not required, all that should be sent being a photograph or drawing, with any notes required to explain special constructional features. On the back of each photograph or drawing sent in the competitor must write his name, address and age, and his entry should be forwarded to "1944 New Year Model-Building Contest, Meccano Limited, Binns Road, Liverpool 13."

Entries will be divided into two sections according to the ages of competitors. Those from readers of 14

years of age or more will be placed in Section A, and those from competitors under 14 will be grouped together in Section B. The contest will remain open for entries until 31st March.

The following prizes will be awarded in each Section of the Contest. First, Cheque for £2/2/-. Second and Third prizes, Cheques for £1/1/- and 10/6, respectively. There will be also five further prizes, each consisting of a Postal Order for 5/-, and Certificates of Merit will be awarded to competitors whose models fall just short of prize-winning standard.

July "Sharp Eyes" Results

This contest was based on an illustration made up from scraps cut from photographs of models in the Meccano Instruction Manuals for Outfits Nos. 0, 1, 2 and 3. Competitors were asked to write down on a postcard the Manual numbers and the names of the models from which the pieces contained in it were cut. In the Home Section the prizes were awarded to the following, who identified all the pieces and whose entries were the most neatly prepared.

1st Prize, Cheque for £2/2/-: M. Munden, Tolworth; 2nd, Cheque for £1/1/-: A. R. G. Burrows, Bourne-mouth; 3rd, Postal Order for 10/6: D. Crawford, Cheam. Postal Orders for 5/-: C. Bradshaw, Sheffield; F. J. Crawley, Louth; S. J. Thurlow, Bletchley; and J. L. Palmer, Speke.



Club and Branch News



WITH THE SECRETARY

MERIT MEDALLIONS OF 1943

This month I give the usual list of Merit Medallions awarded during last year. The total is small, but this is not altogether surprising in view of the fact that the year was the fourth of the war. A further difficulty is that I am now unable to send Merit Medallions overseas, so that the usual contribution of Clubs in Australia, New Zealand, South Africa and elsewhere outside Great Britain and Northern Ireland necessarily is missing. I hope it will not be long before the war comes to an end and Merit Medallions again can be awarded for good work on the part of overseas members.

I congratulate all the members whose names are given in my list on the distinction they have gained, the highest in the Meccano Guild.

AWARDS FOR GOOD WORK

Although in the circumstances the number of Merit Medallion awards for 1943 can be looked upon as satisfactory, we must do more in 1944, which we all hope will be a Victory Year in every sense of the word. I am afraid that some Leaders are not yet alive to the opportunities that the award gives them, for there are still Clubs that are not represented in my annual lists. This is certainly wrong. In all these Clubs there must be officials and ordinary members who have done good work on behalf of the Guild, and whose efforts should be recognised. I should like to press those in charge of Clubs on the point, urging them to make up their minds that they will forward nominations for the two Medallions available each Session for each affiliated Meccano Club. Any kind of good work qualifies a member for the award, and the nomination is made by the Leader or President himself.

PROPOSED CLUBS

- BRIGHTON—Mr. C. A. Kensett, 42, Graham Avenue Brighton 6.
HAMPTON—Mr. P. R. Bradley, 51 Broad Lane, Hampton.
LEICESTER—Mr. H. H. Magnay, 11, Shirley Road, Stonegate, Leicester.
MANCHESTER—Mr. J. Dutton, 21, Dorset Road, Levenshulme, Manchester 19.
SHEFFIELD—Mr. K. Booth, 78, Longstone Crescent, Frecheville, Sheffield.
STRATFORD-ON-AVON—Mr. D. P. Gull, 34, Wood Street, Stratford-on-Avon.
WETHERBY—Mr. E. Jenkinson, 2, Ashfield, Wetherby.

PROPOSED BRANCHES

- BURNLEY—Mr. B. Ennis, 4, Mitella Street, Burnley.
DEWSBURY—Mr. J. Mayman, 67, Revens Avenue, Scout Hill, Dewsbury.
HULL—Mr. D. Kennington, 85, Woodlands Road, Willerby New Road, Hull.
LOUGHBOROUGH—Mr. R. D. Walker, 49, Holt Drive, Loughborough.
NEWCASTLE-ON-TYNE—Mr. W. Pearson, 113, Spencer Street, Heaton, Newcastle-on-Tyne 6.

CLUB NOTES

TYNECASTLE M.C.—Many new members have joined. Flying aeroplane models are popular, and there is great interest in Pole Flying. Solid scale models also are constructed. Chess is now played; sets of chess men have been made by members. Competitions of all kinds are arranged. Many of the members helped to gather the potato harvest. Club roll: 20. *Secretary*: A. Forrest, 228, Gorgie Road, Edinburgh 11.

PLYMOUTH M.C.—The Printing Section continues to provide Club Literature, and Film Shows have provided excellent entertainment. A Games Committee has been formed. Wiring has been the main activity of the Hornby-Dublo Section, which also has enjoyed good running, and the extension of the Club's Hornby Railway is making good progress. Club roll: 93. *Secretary*: S. R. Finnemore, 5, Mutley Plain, Plymouth.

CROSLAND LODGE M.C.—Meetings are varied in character and excellent progress is being made. Chess and Miniature Football Contests, Model-building Nights and railway meetings have been held, and aeroplane "spotting" is a favourite activity. Club roll: 15.

Secretary: D. Graham, 19, Moorside Avenue, Crosland Moor, Huddersfield.

HORNSEA M.C.—The usual varied programme has been vigorously pursued. The "Senior Scientists" have built a small radio receiver, and "Junior Scientists" have made telephones. Model-building also has been carried on, and the Club's Hornby Railway has been put to good use. A 16 mm. projector has been secured and Ministry of Information films are shown regularly. The usual Lectures have been given, the subjects including "Signalling," "Electric Motors" and "The Manufacture of Gas." Club roll: 35. *Secretary*: C. Kemp, 5, Carlton Terrace, Hornsea.

BRANCH NEWS

SHEFFIELD—The Branch Layout is being improved by the addition of model buildings constructed by members, who have also built models of an American locomotive and a "Singapore" flying boat. A large collection of books has been acquired for the Library. Rambles and visits to places of railway interest are being organised. The Branch railway has been overhauled and relaid, and running competitions are now held. *Secretary*: R. Goff, 164, Valley Road, Sheffield 8.

GAINSBOROUGH—The track has been taken up and reconstructed, with two levels giving long runs. Many "realistic bits" in the shape of advertisements, railings, etc., have been added, and electric signalling has been arranged. The passenger rolling stock also has been increased, and the main station enlarged, now providing seven platforms. *Secretary*: F. J. Newman, 26, Birrell Street, Gainsborough.

HOLMELEIGH (WELLINGTON).—Special interest is taken in track designing, members' ideas on this subject being tried out in practice. All give interesting running practice. The Branch Library is making satisfactory progress, and Lectures on railway matters are given regularly. *Secretary*: J. B. Pontefract, Holmeleigh, Station Road, Wellington, Somerset.

A Dublo "Four-Point" System

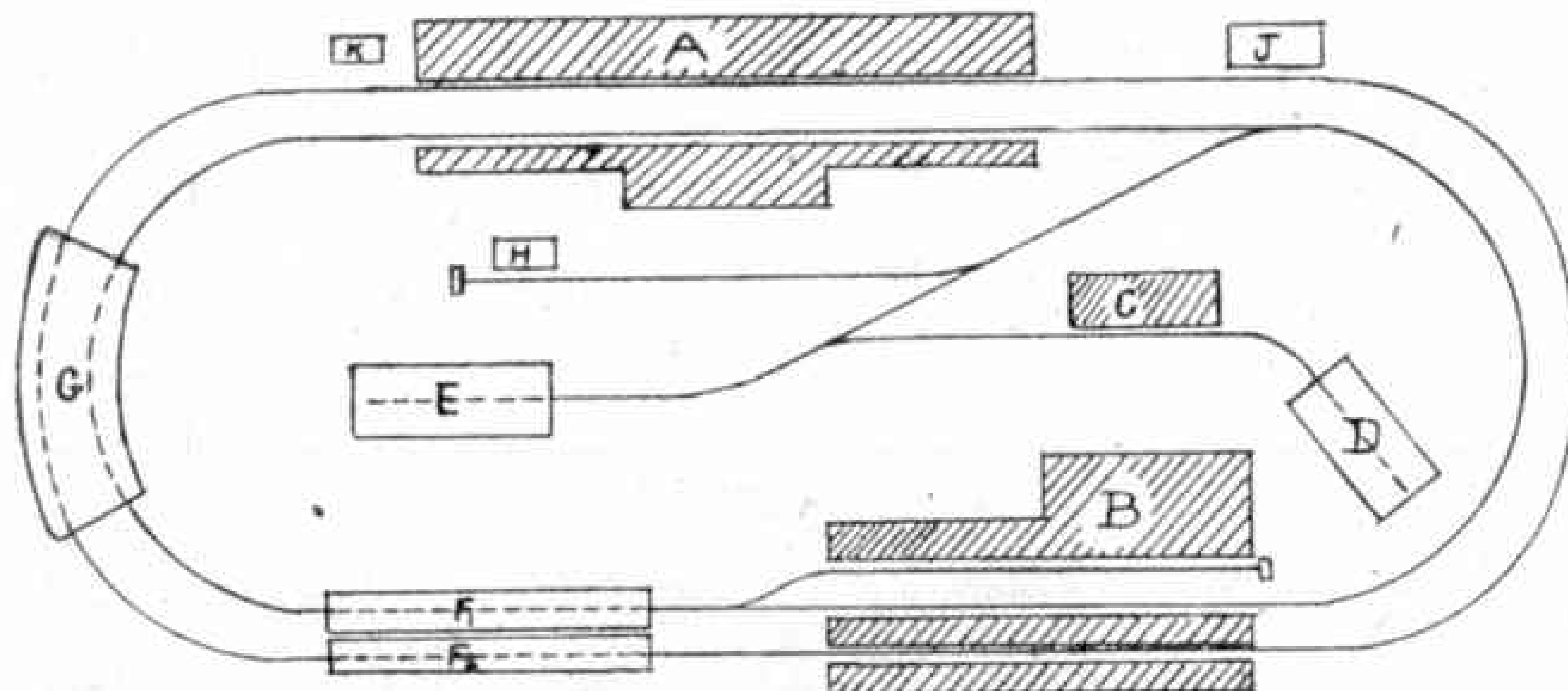
THE Dublo layout illustrated in the diagram on this page is of special interest in showing how a workable system has been developed with a minimum of equipment for the particular scheme in view. On the whole the system is good effort on the part of the owners, J. D. Pawson and J. S. Curle, of Newcastle-on-Tyne, both of whom are 13 years old. They have had to modify the original scheme in various ways. For instance the main line consists of a double track throughout, but owing to the shortage

the "M.M.," with the platform and main building inside the oval, an Island Platform serving the outer track and allowing the onlooker a good view of the trains and the station generally. The other station is larger and is of the more important through or junction type. The track arrangement here is of interest for one of the precious points is used to lead to a terminal track which, with the through roads, makes it a three-track station. There are four platform faces and an all-over roof, and the station offices help to give an air of importance to the place. The terminal or dead-end road is useful for parcels, milk and similar traffic such as is often handled at a special "dock" in a big station. It is handy of course also for refuelling or stock storage purposes.

The layout of the inner yard is really made clear by the diagram, but it may be of interest to draw attention to the uses of the various spur tracks. If we were on an engine entering the yard we should first see a track diverging to the right; this is a coal siding, which has a coal office near it. Here, again to the right, we turn on to

the engine road which runs into an engine shed. This road is conveniently placed to the coal siding, although the latter is principally intended for domestic rather than "loco coal" traffic.

Finally to the rear of us now as we stand on the engine road there is a line serving a goods platform where general merchandise is handled. Further on again this line terminates in a shed which is reserved as a depot for perishable and similar traffic. This



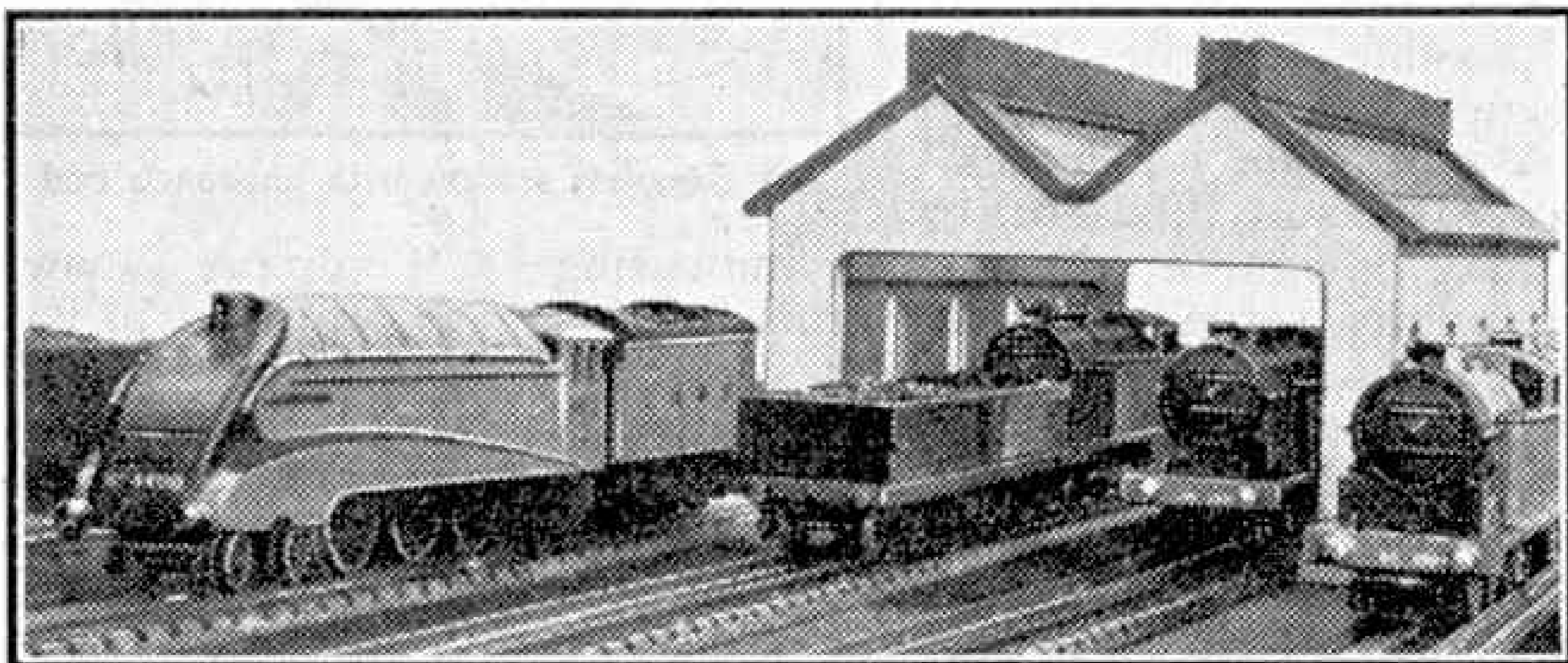
Key to the layout described: A, ordinary station; B, large station; C, goods platform; D, perishable goods depot; E, engine shed; F1, F2, separate tunnels; G, large tunnel; H, coal office; J, signal box; K, platelayers' hut.

of points there is no actual running connection between the two tracks. However, in operating practice things do not work out too badly. The owners of the line refer to the layout as the "Four-Point" system, hence the title to this description of it.

The solution to the isolation of the two main tracks from one another is found in reserving each one for its own traffic. Express passenger trains are kept to the outer track, where they can at all times pursue their way undisturbed. Similarly goods trains run on the inner main track, and as the diagram makes clear they have access by means of points to the various tracks that form the central "yard." A certain amount of shunting to and fro is necessary to work trains in and out of the goods premises, but this only adds to the fun of operations.

The outer track requires no special mention, except to point out that the curves are not laid with the special large radius rails introduced originally to form parallel curves with an existing single track incorporating the standard Dublo rails. This of course is no great disadvantage except that the curved portions of the line do not look as symmetrical as they would do otherwise. However, at the left-hand end of the layout in the diagram the necessarily uneven arrangement of the tracks is partly hidden by the use of a large tunnel! This is, in fact, one of the standard Hornby Tunnels intended for Gauge 0; it does not look too clumsy on the present system, and the fact that it accommodates both tracks is a help.

There are two stations on the main line. The upper one is of the normal main line passing type. It is arranged, as has been frequently suggested in



"On the Shed" on a Dublo layout. Note the Tank shunting out the Coal Wagons.

is a novel feature on a relatively small system and for this purpose the Hornby Engine Shed will do quite well. It will be evident from these details and the diagram that the owners of the layout have put the large area within the oval to good use, yet without overcrowding it. The various spur tracks give scope for interesting shunting operations.

In addition to the tunnels and other accessories, some scenic features such as hedging are included. There are trees here and there and several small cottages. Dublo figures lend "life" to the scene, including one perched on top of a miniature ladder "cleaning" the station windows; and Dinky Toys provide the necessary road traffic items.

Hornby Stations and other Matters

STATIONS on a miniature railway system are almost as necessary as the track itself, for they form the only places at which passenger trains can be started and stopped in a realistic manner.

A scheme that is much in favour is to "invent" a section of a real railway. In other words, you imagine that certain places are served by your favourite line. Here you are not tied down to the actual stations or services of a particular real section, and so greater latitude is possible in the way of station arrangements. A three-platform "Euston" may arouse comment, but you can get away with it if your terminus is called "Notchester." This really is not at all a bad scheme, for the practice and running operations of the line you like best can be reproduced, joint working and other modifications can be introduced, and so on.

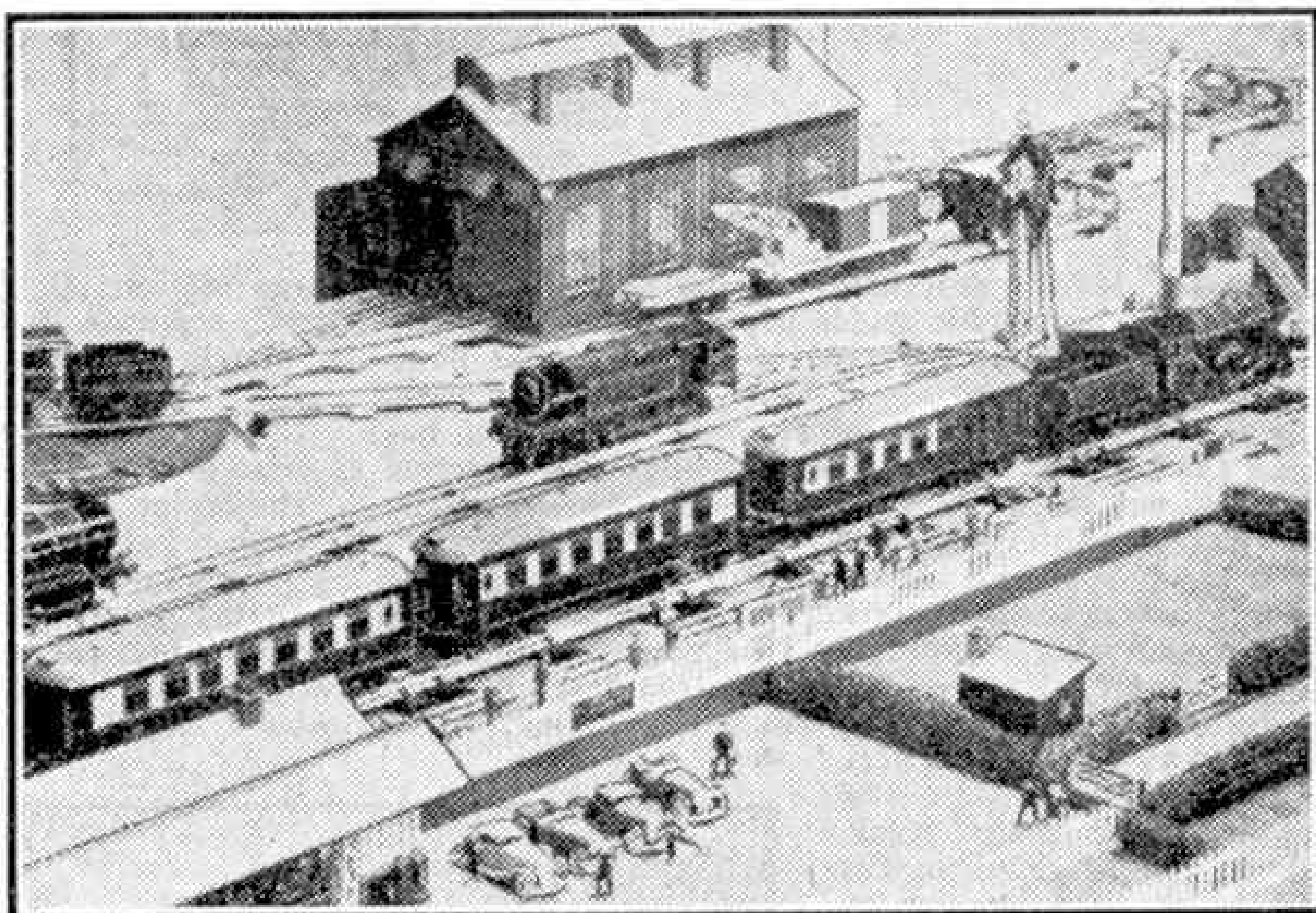
There is one point that should be watched, however. To be strictly accurate, particular named trains of actual practice should not be represented, although of course with the usual model railway licence they often are! It is possible for the "Chief Operating Manager" to devise titles for his "crack" trains to suit himself; or he may be content with simply indicating the points served by the trains on his destination boards.

A good example of this type of line is the "Bincliff, Lakeside and Shedley" section of the L.M.S. This is the title adopted by Mr. C. B. Smith, of Lincoln, for his layout that was referred to in some detail in the "M.M." last October. The railway is outside, and the "place names" are suggestive of the situation of the various stations. Two of the locomotives of this line are included in the upper illustration on the next page.

A further development of this kind of thing is found in what are generally termed "freelance" layouts. Here the owner more or less develops his own practice, the railway and the district it serves being imaginary. Thus the stations can be even more imaginary in their arrangement,

although they may be perfectly well adapted to the traffic with which they have to deal. As a rule these schemes are quite successful, and most interesting inter-working with the different lines can be arranged. Such is the scheme of things on the "Hebble Valley Railway" of Mr. A. R. Wilson, of Halifax. Readers may recall references to this line in past "M.M.'s," the general scheme being an imaginary system "somewhere in the West Riding" of Yorkshire.

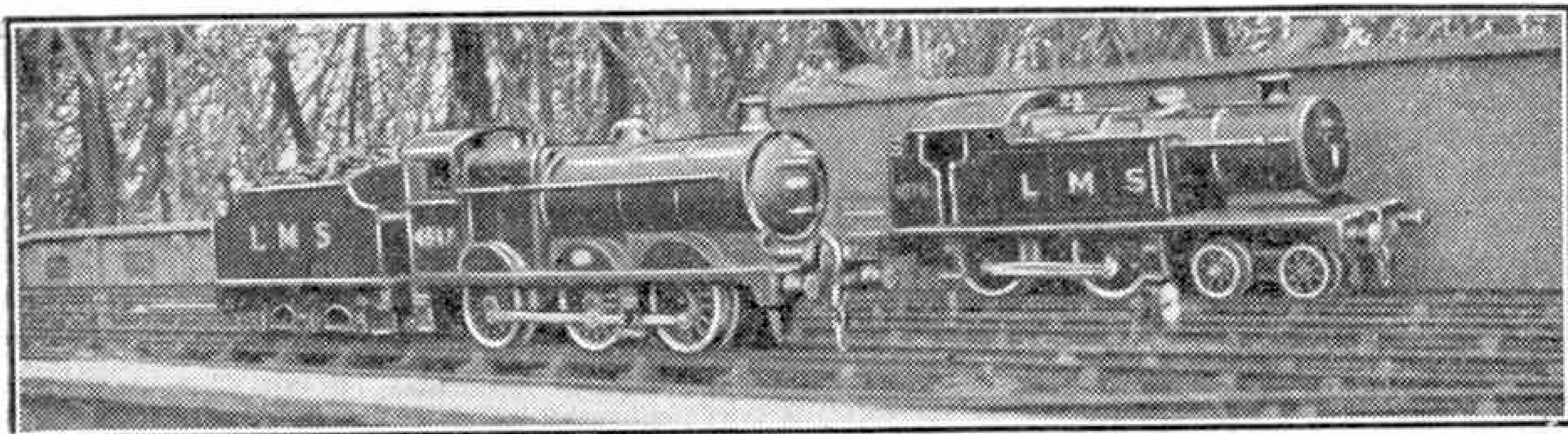
The railway is connected with the L.N.E.R., and in fact L.N.E.R. engines and trains work on it in addition to the



A complete station with approach and yard on a continuous system.

"Company's" own stock, much of which is supposed to have been got from various lines. This explains the appearance in the lower illustration on the next page of an ex-L.M.S. (L.N.W.R.) "George the Fifth" locomotive at the head of a "Hebble Valley" train standing in "Heckdyke" station. The station itself is a recent enterprise on the part of the "Engineering Department," and is constructed of wood and cardboard, finished off with printed paper details. It makes a splendidly realistic stopping place.

Continuous layouts, on the other hand, are often based on a single station. This is developed in fair detail as far as space will allow, and it forms as it were the focal point of the whole system. In such cases the operator is not concerned with the actual working of trains from point to point, but he deals with them in much the same way as the station master or

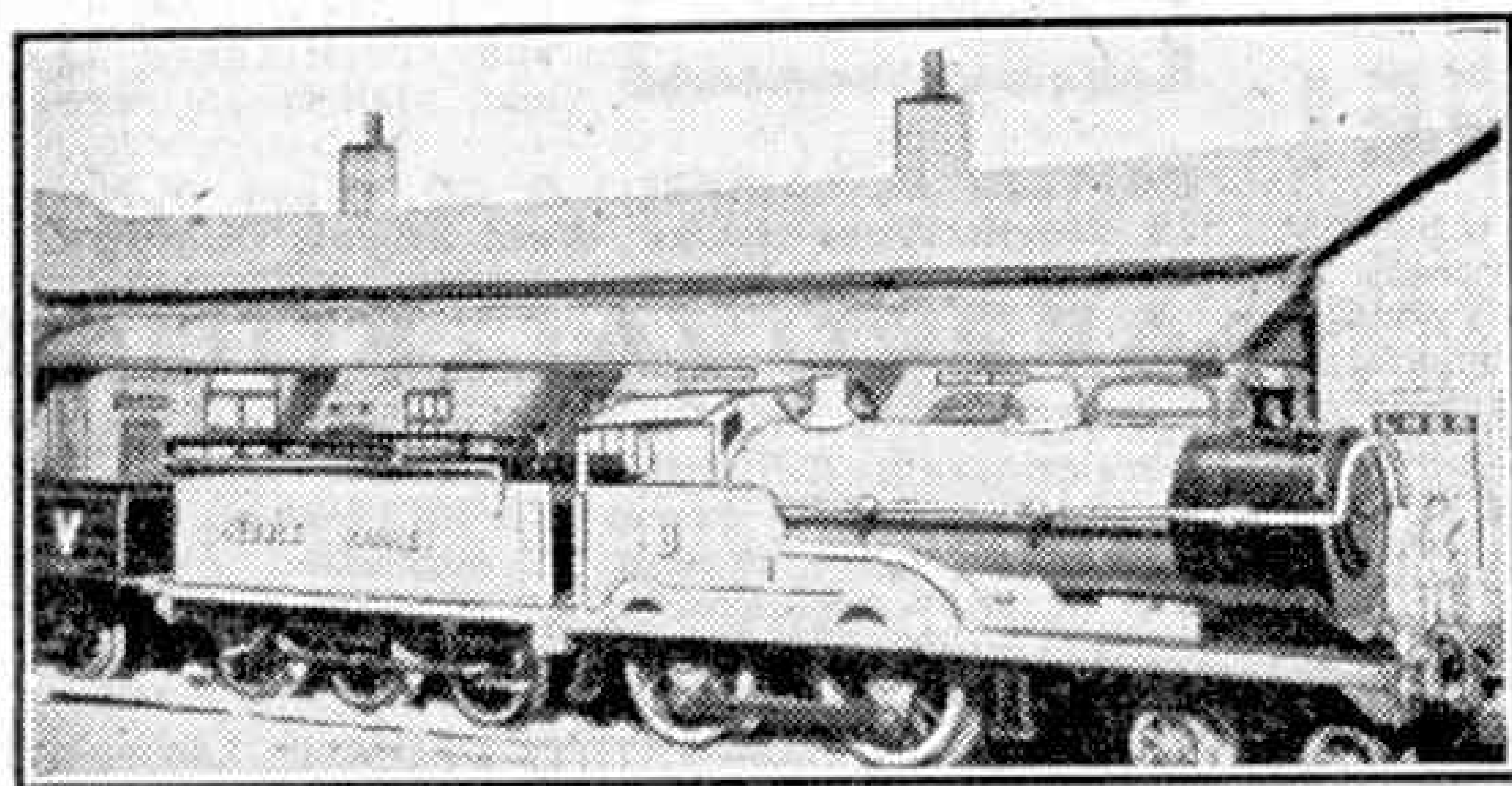


Two of the engines on the "end to end" layout of Mr. C. B. Smith, Lincoln.

traffic controller at that particular point. There is a good deal to be said for this scheme too, but it is for the individual enthusiast to decide exactly how he approaches the subject.

At a station of the type just referred to the general equipment is usually more complete than is possible on a point-to-point line. There will be a road approach with all its possibilities in the way of miniature figures, road traffic, poster hoardings, and all the usual external station features apart from the railway itself. There may be a level crossing, goods sidings with a goods depot or at least a loading "bank," and there may be in addition a special raised platform and pen for livestock traffic. Shunting and the

therefore of the "through" type. It is, however, possible to arrange the station as the terminus of a "there and back" kind of layout. This of course is a non-continuous system in which the trains, having started, make their way back to the starting point, and are there dealt with as arrivals quite different in identity from when they set off. Traffic working on these lines can be quite highly developed, and running can proceed almost continuously if the layout has been planned to suit the workings that the operator has in mind. Empty stock working in and out, the handling of light engines before and after their runs, and many other similar operations, are all necessary in addition to the actual despatch and, later, arrival of trains.



A train at "Heckdyke" station on the "Hebble Valley Railway" of Mr. A. L. Wilson, Halifax.

making up of trains, the attachment to and detachment of odd vehicles from trains that stop in the station, form the bulk of the work done at a station of this kind, and they can all proceed "according to plan." Through coaches and joint services with the engines and stock of another line can add to the variety of interest on the passenger side, while in addition there may be a locomotive depot so that the changing of engines can be practised on certain trains.

As a rule, as we have said, a station of this type is on a continuous layout, and is

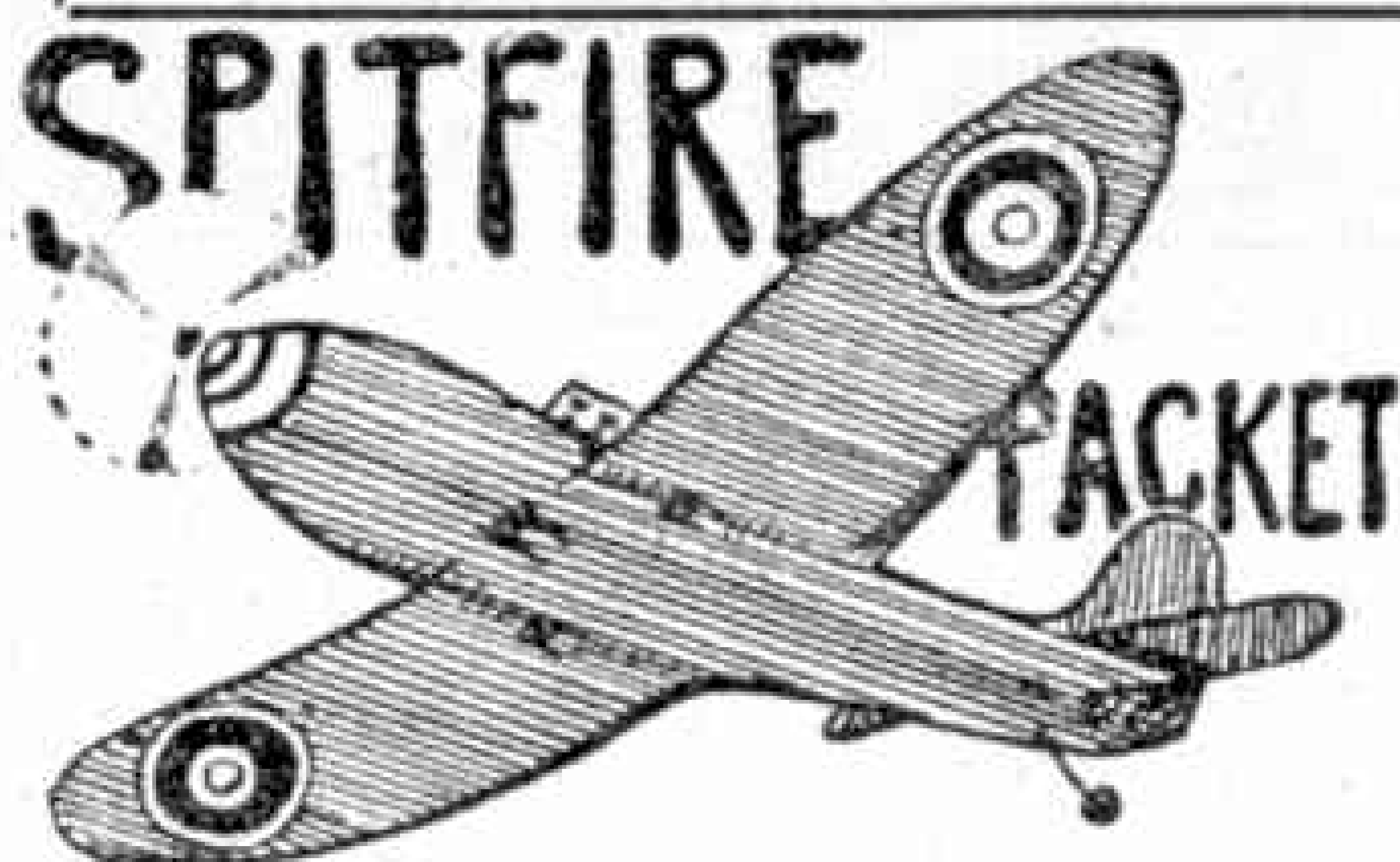
Using the terminal working scheme it is possible to have a great deal of fun and yet carry out quite realistic operations with a more or less limited amount of stock. As the individual "down departures" become "up arrivals," there are really no separate "down" or "up" trains. Again, it is usual to concentrate on passenger train working to a great extent, so that the number of freight vehicles is reduced to those that can be run in passenger trains. It is naturally permissible to handle specially perishable freight and goods traffic at a passenger terminus, so that the "goods interest" is not entirely absent.

Even temporary or portable railways on these lines can be quite entertaining, and a great deal of space, by Gauge 0 standards, is not required, especially if the trains are reasonable in length. Incidentally the illusion that the departure and arrival are separate trains will be heightened if the tracks enter a tunnel outside the station, so that they are removed from the view of the operator, for a short time.

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For other Stamp Advertisements see pages 68 and viii.



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Stamp Collecting

Making a Good Display

By F. Riley, B.Sc.

LAST month I explained how to make a good start with the hobby of stamp collecting. In that article I was concerned with the stamps themselves, how to get material with which to start a collection, and how to extend this and make it as complete as possible in the sphere selected by the collector.

Now we must turn to the mounting and display of stamps. For this an album is the first necessity. I have known boys, and even older people, who keep their stamps loose in boot boxes or in some other form of container. This is bad practice. The stamps have to be searched for and handled whenever one of them is wanted for any purpose, and no stamps can remain in even fairly good condition when they are continually being thumbed and thrown about loose along with others. There is certainly no pleasure in looking at such a mass of stamps, and every "M.M." reader who is beginning stamp collecting should make up his mind that somehow or other he is going to mount his stamps in an album of some kind.

A few years ago there would have been little need for emphasising this, for albums of sizes and prices to suit everybody, from beginners to the most advanced collectors, were to be seen on every hand. Owing to the war these have become decidedly scarce. They can still be bought, however, and one should be got if at all possible, even if it does not meet the collector's requirements in full. There will

come a day when albums again will be plentiful. By that time the collector will know better what he needs for his stamps, and he will then be in a position to buy a more suitable album, perhaps one of the fine variety in which there is a space set apart for every stamp of the country or countries in which he



is interested, often with an illustration.

The usual beginner's album has one page or more devoted to each country, and such albums have a habit of becoming lop-sided, well-filled pages for certain countries being followed by a series of blanks on those for stamps that are more difficult to get. This is perhaps inevitable, but a very fine display can be made in time, even with an album of this elementary kind, by steadily seeking out, by the methods described last month, the stamps required to fill the gaps. If at all possible a loose-leaf album should be used. This is elastic, for additional sheets can be introduced at will, so that if the stamps for any one country become too

numerous for the sheets allotted to them to begin with, the overflow can be accommodated in the right place, and without

overcrowding. Loose-leaf albums are becoming more and more popular, and deservedly so, for they can be used continuously as stamps accumulate, and can be adapted to changes of plan on the part of the stamp collector.

One point that should always be borne in mind is that the stamps mounted in an album necessarily make it thicker. If at all possible therefore an album that provides for this by having narrow strips of paper bound in between the leaves should be used. The strips remain under the binding, and separate the album leaves sufficiently to allow ample room for the stamps. An album of this kind does not become bulky and misshapen when it is full. Another point to remember is that sheets of thin tissue paper should be placed over the stamps. Interleaving such as this keeps them clean, and, above all, prevents them from being rubbed as the album is opened or closed.



What are collectors to do who find it impossible to buy a suitable album? For them the best course is to make one. This may sound a little ambitious, but it is not difficult to put together a simple volume that will serve the beginner well for the present. A

good home-made album of the loose-leaf type can be made by fastening sheets of good strong paper together in a spring back binder of some kind, or in some letter filing device. I have seen one excellent temporary album made in this manner with the spring back binder sold for holding copies of the "M.M." This is meant only as a temporary device, but the sheets have been carefully cut to the required size and fixed in the binder with separating strips of the same paper between successive sheets, and the result is excellent.

It must be emphasised that a home-made album of this kind can only be regarded as a temporary home for a worth-while collection. As a solution of present-day difficulties it will prove satisfactory, and for the beginner it has the advantage that it gives him time in which to work out a plan for his collecting and for the display of what he collects, so that when the day comes for him to buy a good album he will make no mistake.

After arranging the means for a display, the next thing is to mount the stamps.

There is only one satisfactory way, and that is by means of stamp hinges. In ordinary times it was advisable to buy the very best hinges available, which were only slightly more costly than common ones.

To-day only Utility hinges are available, but these can be used with satisfactory results if they

(Cont. on page 69)



FREE! To commemorate the birth of Princess Margariet in Canada, the Free Netherlands Government have issued



special postage stamps in the design illustrated. These stamps are for use in the Dutch Colonies of Curacao and Surinam, and they depict a family group of the Dutch Royal Family. The baby Princess is shown with her two sisters; her mother, Princess Juliana; her father, Prince Bernhard; and her famous grandmother, Queen Wilhelmina.

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For other Stamp Advertisements see pages 66 and viii.

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Stamp Gossip and Notes on New Issues

Our December Stamp "Quiz"

It is clear from the entries in this competition that readers know their stamps. For instance, practically every competitor



stated correctly that the smallest British stamp ever issued was the 1d. rose of 1870 and that the largest was the £5 value of 1867. They were not all so successful in naming a stamp on which there are a few bars of music. A few years ago there was only one, the 1936 Brazil 700 r., issued in two colours to celebrate the birth of the composer Carlos Gomes. Since then four

other stamps with this feature have appeared. One of them was the Kallio memorial stamp issued in Finland in 1941, and illustrated on page 105 of the March 1943 "M.M." This reproduces the opening bars of the National Anthem of Finland. The others are Russian and appeared in 1940, the occasion of the Tschaiakowsky centenary. The 20 k. and 30 k. values give a passage from "Eugene Onegin," and on the 60 k. is an extract from the composer's Fourth Symphony.

"Bulls' Eyes," illustrated in the "M.M." for March of last year, were the earliest stamps of Brazil, and "Missionaries" were the first Hawaiian stamps. Countries from which stamps with the values shown in the fourth question were issued are Russia, with various



associated states, Rumania, Turkey, Poland, Yugoslavia and Iceland. The reply to No. 5 is that two queens have been portrayed on British stamps, Queen Victoria and Queen Elizabeth. A few entrants tried to get away with Britannia, on the score that she is the Queen of the Ocean!

Finally the originator of the 1d. post was Sir Rowland Hill, and portraits of this pioneer appeared on

centenary stamps issued in 1940 by Portugal, Brazil, Paraguay, Salvador, Cuba, Nicaragua and the Dominican Republic. The Brazilian example was illustrated in the March 1943 "M.M."

The two prizes of 10/- and 5/- have been awarded to D. Rayner, Riddlesden, and P. Penn, Southampton. There were other splendid entries little behind these in merit, and I have awarded consolation prizes of 2/6 each, to M. Crowdy, Kendal, K. Kewish, Liverpool,

and H. Sutherland, Airdrie, respectively.

Look out for another contest next month, with an increased prize list.

Recent New Issues

This month I illustrate four of the Free Polish war stamps described in full in last month's issue. The values reproduced are the four lowest, showing respectively an attack on a U-boat, repelling air attack on a convoy, an anti-tank gunner in action, and Polish troops looking down on Narvik Fjord, and they are typical of this spirited pictorial issue.

The illustration at the foot of the page shows the design of the Free French set from Reunion, to which I referred also last month. This is in 14 values, from 5 c. to 20 f., with a design by the famous artist Edmund Dulac reproduced in a wide range of colours. The stamps illustrate the chief products of Reunion.



Making a Good Display—(Continued from page 67)



are treated with care.

It is not enough merely to lick a hinge, stick it on a stamp, and then bend part of it over and stick it on the page. That way leads to trouble when a stamp has to be removed. Instead, fold the hinge with

the gum on the outside, so that one portion is about twice as long as the other. Lightly damp the end of the smaller portion—do not wet it all over—and attach it to the stamp with the fold just below the perforations, taking care to place it straight in the middle of the stamp. Then damp the end of the larger portion, carefully place the stamp in the position it is to occupy, and press down the hinge just sufficiently to make it adhere to the page. A stamp mounted in this manner can be turned up easily so that the gum and the watermark at the back can be seen.

Some day it may be necessary to remove a stamp from the album, either for replacement or because of rearrangements. It should peel off easily, and clearly a better result is more likely when the hinge is lightly attached, by following the plan just described, than if it is simply stuck on anyhow. Good hinges peel easily; bad ones bring away with them part of the surface of the paper, or of the stamp if they are

pulled off the stamp itself. Another point that collectors should keep firmly in mind is that no effort should be made to peel off a stamp before the gum has dried, for that too will tear away the surface of the paper. If therefore in mounting a stamp it is accidentally put in the wrong place, or is not straight, do not try to remedy this immediately; leave that for another day. Otherwise serious damage to the album or the stamp will follow.



A FINE A.T.C. MODEL AEROPLANE EXHIBITION

A feature of the Air Training Corps Exhibition at Harrods last month was a fine show of over 90 model aeroplanes made and entered by London cadets. Sir Frederick Handley Page, C.B.E., the famous manufacturer of the "Halifax" bomber, paid a special visit to the exhibition with Air Chief Marshal Sir William Mitchell, K.C.B., D.S.O., Commandant, A.T.C. (London Command) to judge the models. These ranged from "Spitfires" and "Lancasters" to "Liberators," F.W. 190's and even a German seaplane. Sir Frederick found his task of judging far from easy, and congratulated all concerned on the really excellent standard of work.

The full exhibition was on view later at the Hammersmith Town Hall for one week in connection with the Borough's A.T.C. Recruiting Week, and is now touring provincial centres.

P.R.U.—(Continued from page 41)

down on him.

Some of the P.R.U. pilots could tell exciting stories of escapes from such waylayers, but prudence, and very largely modesty, keeps them quiet. Because they do not dash into action with guns blazing and radio crackling, some of them look on their work as tiring perhaps, but comparatively safe. But the bombers who work by the P.R.U. pictures think of the P.R.U. pilots as the best of the bunch.

Photographing targets for bombers is not their only job. They go hunting for German warships in the fiords of Norway or the harbours of the Baltic, which is cold, lonely work. They cover France and the Low Countries and go far into Central Europe hunting for new features in the landscape—new factories going up, new railways or roads being laid, new power-dams being built, or artificial lakes filling up.

If the bombers may be called flying artillery the P.R.U. may be called flying telescopes. Without them the Navy, the Army, and the Air Force would be blind.

BRIDGE THAT IS LOWERED UNDER WATER

The Shatt-al-Arab, the waterway formed by the union of the Euphrates and the Tigris a few miles above the Persian Gulf, can now be crossed on a novel road and rail lift bridge in which the span is lowered under water instead of raised to provide passage for vessels on the river. This unique bridge was built by British Army engineers. It has a deck 15 ft. wide, and the lift span is 92 ft. long and weighs 35 tons.

COMPETITION RESULTS

October "Railway Shunting" Puzzle.—This competition aroused very great interest, and there was considerable variety in the solutions, some of which required far more moves than are really necessary. The simplest solution is as follows. Couple the locomotive to 4, 5 and 2 and shunt 2 into CD. This leaves EF clear, and 4 and 5 are shunted into it. The next step is to couple 3, 1 and 2 and draw them into BC, clear of CD. Then 3, 4 and 5 in succession are shunted into CD and drawn forward, and when this is done with 5 the whole train is marshalled and ready to depart.

In another neat solution 4 is shunted into BC, 1 being pushed to CD and 4 and 3 drawn back to BC. Then 5 is shunted into BC where we now have 5, 4 and 3 in that order. Next 1 is drawn into GE and coupled to 2, 1 and 2 then being drawn well forward into GE. Now 3, 4, and 5 are shunted successively to

CD and picked up from there by part of the train already assembled in GE.

The winning entries gave solutions along these lines, as did many others, and it was necessary to take neatness and novelty into consideration in awarding the prizes. The winners' names are as follows:

1. G. Norton, Nottingham. 2. P. Hilsden, Stanmore. 3. A. Smedley, Swinton. Consolation Prizes: F. Mills, Kearsley; T. G. Reeday, Wakefield; D. Martin, Northenden.

October "Meccano Parts" Puzzle.—Readers must have enjoyed the task of deciding which Meccano Parts fitted the 12 clues given in this competition, judging by the number of entries. The 12 parts represented are: 1. Channel Bearing. 2. Wire Line.



Sir Frederick Handley Page, C.B.E. and Air Chief Marshal Sir William Mitchell, K.C.B., D.S.O., examining Handley Page "Halifax" models in the A.T.C. Exhibition in London last month.

3. Dog Clutch. 4. Crane Grab. 5. Digger Bucket. 6. Eccentrics. 7. Sleeve Pieces. 8. Shuttles. 9. Sand Rollers. 10. Threaded Bosses. 11. Flywheels. 12. Spring Buffers. The prize-winners are as follows:

1. R. Tydeman, Ipswich. 2. B. A. Smith, Chorlton-cum-Hardy. 3. D. G. Scales, Wembley. Consolation Prizes: E. G. Smith, Manchester 21; T. D. Tasker, Barnsley; M. Munden, Tolworth.

October "Photographic" Contest.—1st Prizes, Section A: W. Wyatt, Liverpool 19; Section B: J. Marland, London W.7. 2nd Prizes: Section A: A.C.1 Atkins, Eccles; Section B: G. W. Peile, London S.E.1. Consolation Prizes: J. Cowpertwait, Leicester; T. Bird, Luton; Miss H. Barry, St. Minuer, Nr. Wadebridge; M. R. Lole, Horsham.

November "Photographic" Contest.—1st Prizes, Section A: C. A. Reader, Guildford; Section B: D. Humphries, Sheffield 5. 2nd Prizes: Section A: J. E. Martin, Fishguard; Section B: K. Davies, Dursley. Consolation Prizes: F. Barr, Birkenhead; A.C.2 Brown, Cosford; P. Milne, Whyteleafe; J. A. Coward, Liverpool 16.

RESULTS OF NOVEMBER **BSA** MISSING WORD COMPETITION

For the best and most apt sets of answers, of equal merit, the judges have awarded prizes to the following 7 entrants:—

Allison Scott, Newcastle-upon-Tyne; Hector Roy, Dumfries; Kenneth Bond, Ramsey, Hunts; S. Taylor, Harleston, Norfolk; Lily Nicholl, Belfast; D. Brooks, Heston; D. Salway, Rhondda; each receiving an equal share of the £10 in prizes.

Competitions! Open To All Readers

A Knight's Tour Puzzle

For our competition this month we are returning to a Knight's Tour Puzzle of the kind that proved a great attraction to readers early last year. In this a passage containing 64 words is disguised by means of a simple code. The words of this are given in the spaces in the accompanying diagram, which represent the squares of a chess board, and it can be read by starting at a certain point and moving about the board as the Knight moves in a game of chess. Every square in turn is visited in this tour, so that every word in the passage is revealed.

Those who play chess will know how to make the moves, and these can easily be learned by others. Starting from any square a Knight moves two squares horizontally or vertically in either direction, and then one square in the opposite sense. For instance, if the first part of the move is two squares up or down, then the second move must be one square to the right or left. Similarly a two-square move to right or left must be completed by a move of one square up or down.

All that is necessary in this puzzle is to find the starting place and to make one Knight's move after another, selecting in each case the one out of those available that seems to lead to the best result.

When the passage has been worked out it must be written on a postcard or a sheet of paper and forwarded to "February Knight's Tour Contest, Meccano Magazine, Binns Road, Liverpool 13." The name and address of the competitor must be clearly given on the entry.

air	with	to	the	heights	move	get	heights
burn	engines	the	to	air	where	these	with
and	is	it	will	speedy	The	great	not
of	their	able	new	flights	be	a	At
free	sound	can	very	aircraft	and	could	at
fuel	an	jet	indeed	be	usual	means	speed
of	from	of	by	than	and	made	type
aircraft	except	that	bumps	the	special	greater	cloud

There are two sections in this contest, for Home and Overseas readers respectively, and in each there will be prizes of 21/-, 10/6 and 5/-, for the best entries in order of merit. Consolation prizes also will be awarded, and novelty and neatness will be taken into account if necessary.

Closing dates: Home Section, 31st March; Overseas Section, 30th September.

Queer Station Names

Railway enthusiasts find it interesting to look through the lists of stations that appear in timetables, especially as some of the names are unusual and often puzzling or amusing in character. For instance, looking down the index pages of an old Bradshaw we come across such names as Monument, Old Leake, Black Horse Road, Boar's Head and Four Marks. It occurred to us that some of these unusual names would form a very good subject for a competition. We have therefore picked out 20 of them, and below we give clues that will lead to these names, all of them those of stations to be found on British railways.

1. An exchange for money.
2. Used for making roads.
3. Valley that should be valuable.
4. Deep and high.
5. Stagnant and flowing.
6. Crossing wet and dry.
7. Place for loading black diamonds.
8. Number, distance and neither length, breadth nor thickness.
9. Feed for animals.
10. A chime stops sounding.
11. A treasure wood.
12. Strikes sparks.
13. Cross road in the sky.
14. Springs eternal.
15. Seen near the shore.
16. Sounds well up.
17. Famous model railway suggests this.
18. Something to swallow.
19. Must be beginning or middle.
20. Red-berried.

To make it clear what competitors are asked to do we may take No. 1 as an example. "An exchange for

money" suggests selling something, and almost immediately points to Sale, in Cheshire, as the station that is indicated by the clue. Some of the puzzles may be a little more difficult, but all are of the same kind and should easily be solved.

This competition is open to every "M.M." reader. All that an entrant has to do is to make out a numbered list of the 20 stations concerned, to add his name and address, and then to forward the result to "February Station Names Contest, Meccano Magazine, Binns Road, Liverpool 13."

For the best lists of replies prizes of 21/-, 10/6 and 5/- will be awarded in each of the two sections of this contest, for Home and Overseas readers, respectively. In addition there will be consolation prizes, and in the event of a tie the judges will take novelty and neatness into consideration. Closing dates: Home Section, 31st March; Overseas Section, 30th September.

February Photographic Contest

This month's contest is the 2nd of our 1944 series, and in it, as usual, prizes are offered for the best photographs of any kind submitted. There are two conditions: 1, that the photograph must have been taken by the competitor, and 2, that on the back of each print must be stated exactly what the photograph represents.

Entries will be divided into two sections, A for readers aged 16 and over, and B for those under 16, and all entries must be clearly marked with the section letter. They should be addressed "February Photographic Contest, Meccano Magazine, Binns Road, Liverpool 13." There will be separate sections for Overseas readers, and in each section prizes of 15/- and 7/6 will be awarded. Closing dates: Home Section, 29th February; Overseas Section, 31st August.

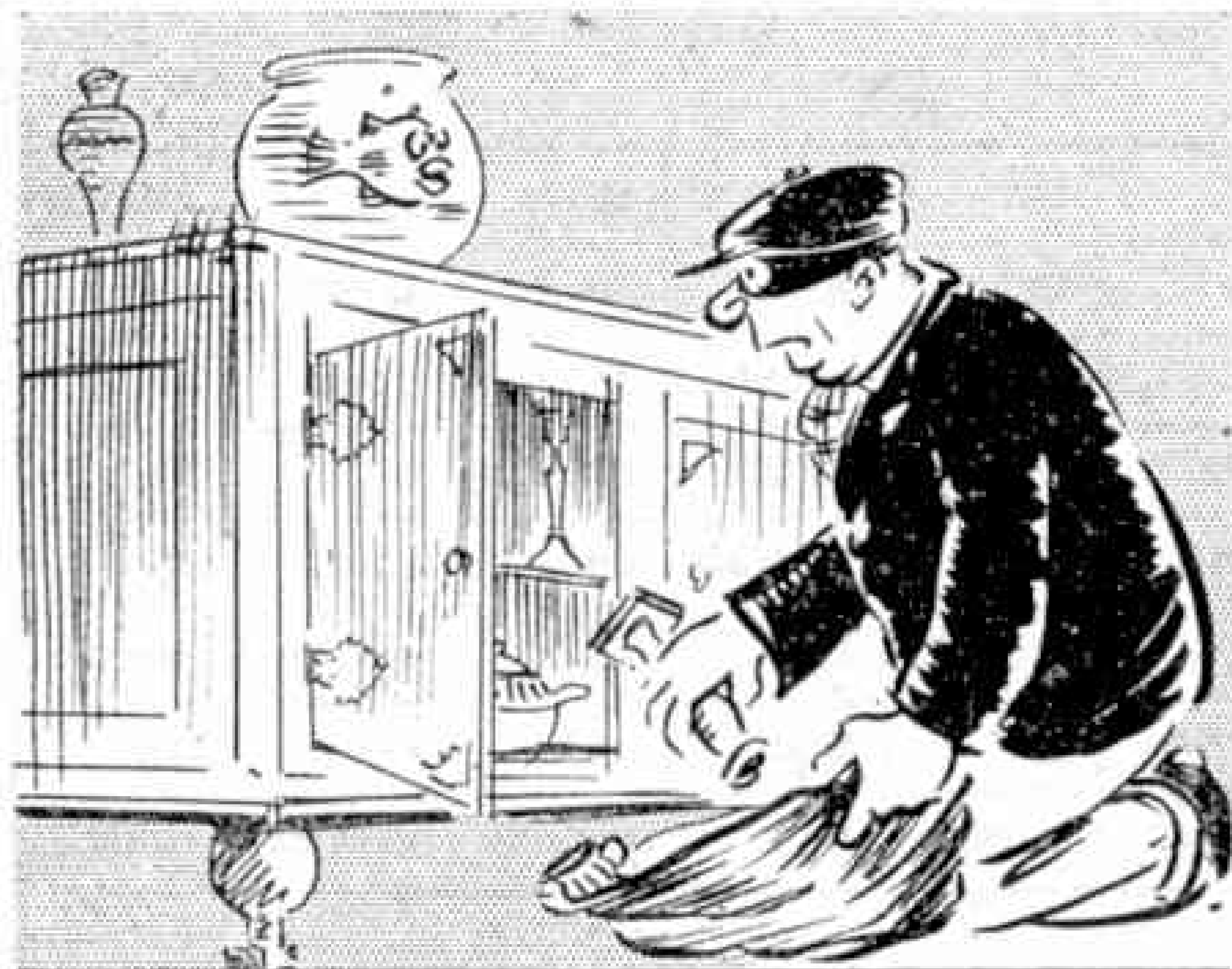
Fireside Fun

Football Captain: "You want to play for us, do you. Are you any good as a goalkeeper?"

Applicant: "Oh yes, I'm passable."

Captain: "No good. We want somebody who is impassable."

* * *



"Who are you starin' at?"

* * *

Father: "What are you doing at the bottom of the class?"

Son: "The same as the other boys, father. They teach the same things at both ends."

* * *

"Why don't you take a holiday? You look ill."

"No, I can't stay away from work."

"Surely they could do without you for a week."

"Longer than that, but I don't want them to find out."

* * *

Employer: "Why should I pick you out of the dozens who have applied for the job this morning?"

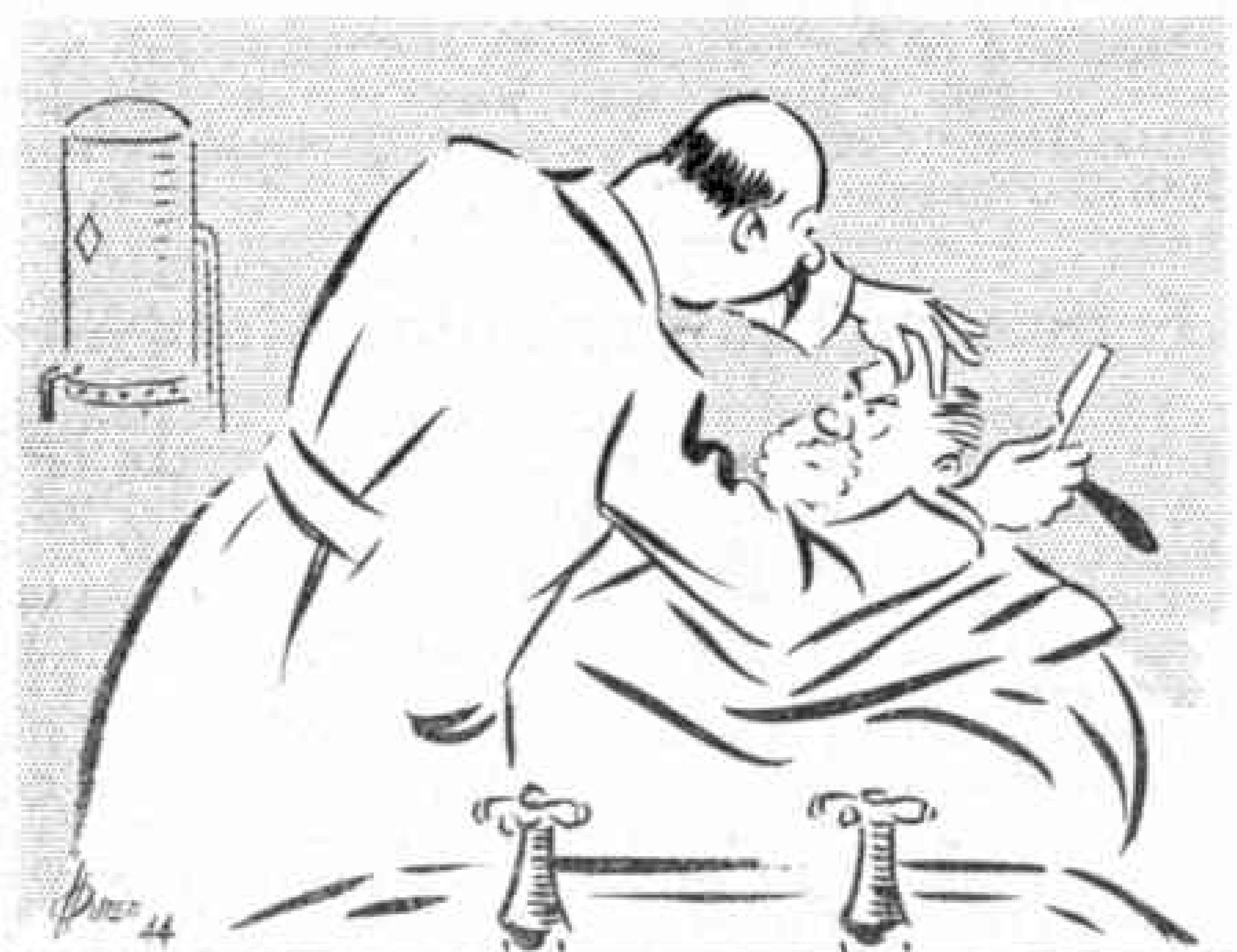
Applicant: "I'm the only one who has brought his dinner, sir."

* * *

THIS MONTH'S HOWLER

Kangaroos are born in leap year.

* * *



"Were you wearing a red tie when you came in, sir?"

"No, I wasn't."

"Oh, gee!"

BRAIN TEASERS

CRAZY SUMS

How can three matches make six, nine make 36 and 11 make nine? When you have found out place four matches side by side, about 1 in. apart, and add two more matches to leave nothing.

While we are playing with matches use eight of them to make four triangles and two squares.

URGENT

Here is a strong appeal with which we shall all sympathise.

S E N D
M O R E

M O N E Y

Do not be alarmed; you are not asked to forward subscriptions for anything. The above is really an addition sum, and you are asked only to find the numbers to fit it. There is only one set.

A FRUITY PUZZLE

A merchant had orders for two lots of oranges, one of 3,094 and the other of 4,862. What is the least number of packing cases, each containing the same number of oranges, that he would require, and how many oranges would there be in each?

TEN ROWS WITH NINE DOTS!

For an easy one to end with this month, try to arrange nine dots in 10 rows, each containing three dots. It can be done.



"Don't go messing about with my Hornby Trains, Dad. They can't be replaced these days."

SOLUTIONS TO LAST MONTH'S PUZZLES

The missing vowel in our first puzzle last month was E, and when the 10 E's are put in the right places the complete sentence reads: "THE ELEMENTS EXCELLED THEMSELVES."

It will easily be seen that 120 is the lowest number that is divisible by 5, 6, 8 and 12, and so the curate of our second problem should have divided the children into 11 teams of 11 each, for there were 121 of them.

The solution to the first part of our third puzzle is 10. The two smaller numbers of the second part are 4 and 2.

The first crack in the face of the watch that was dropped enclosed X and the X of IX; from the rest the second crack cut off VIII, XI and the I of IX; the next then cut off XII, I and VII, leaving II III, IV, V and VI on the last portion.

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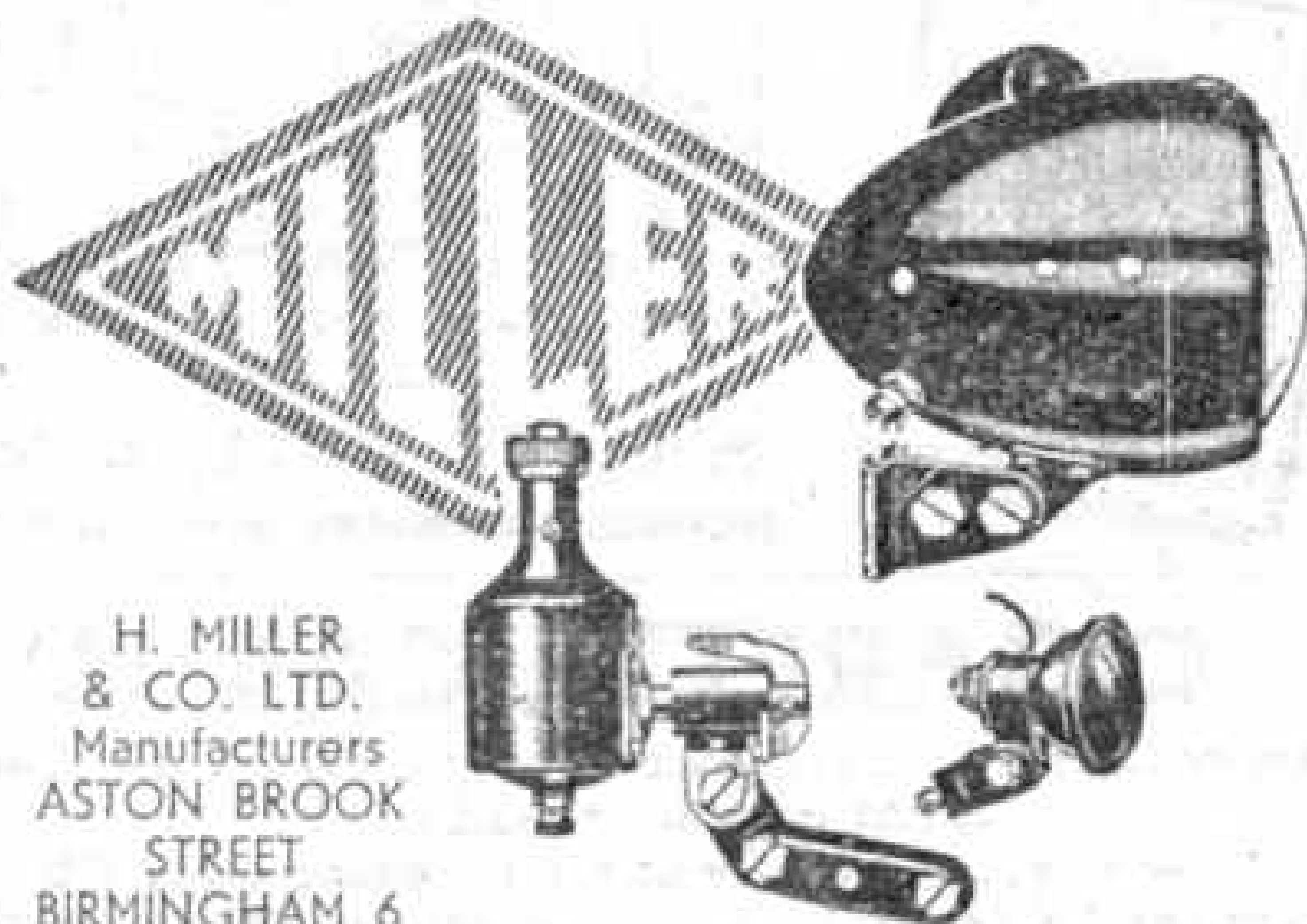
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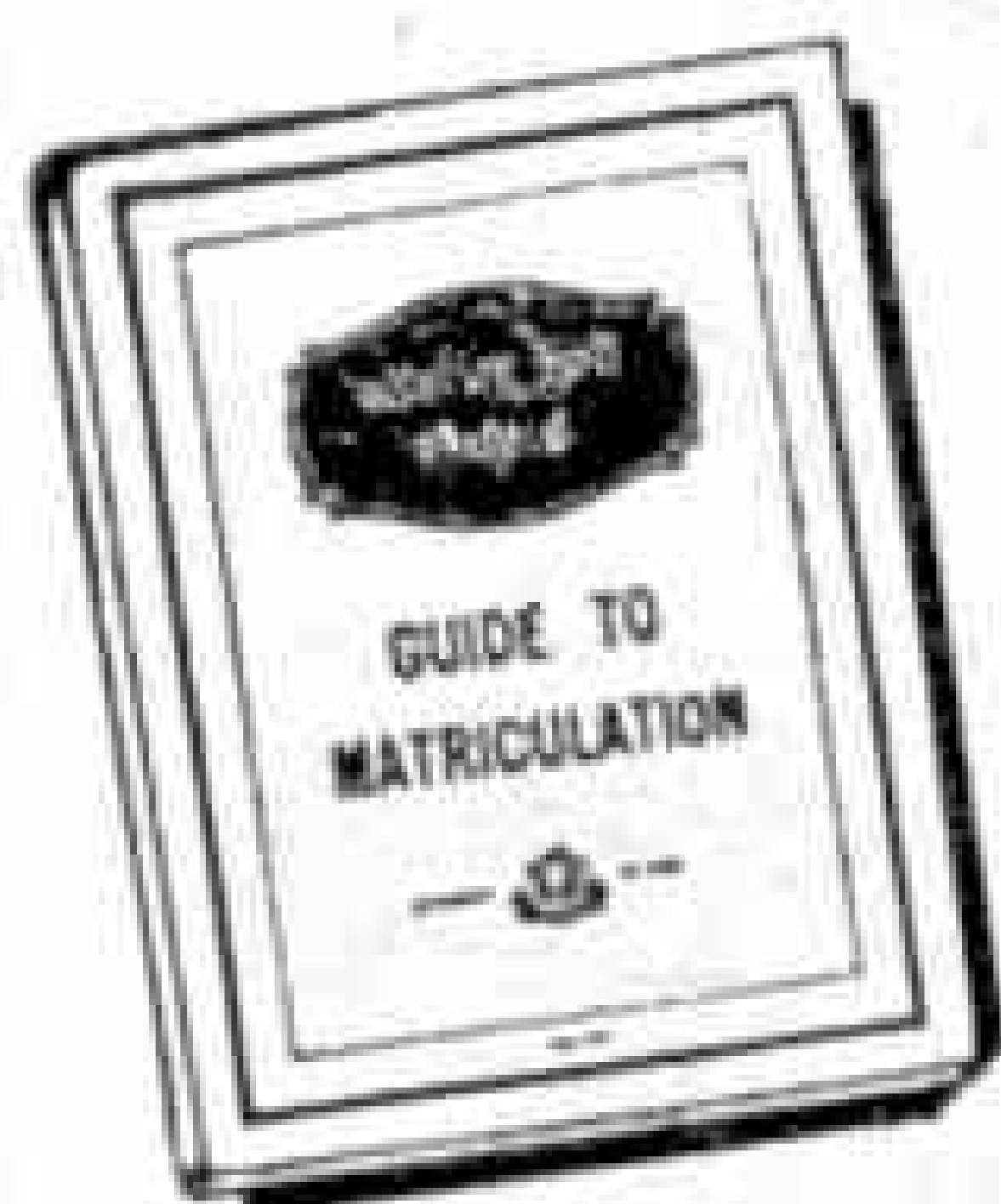
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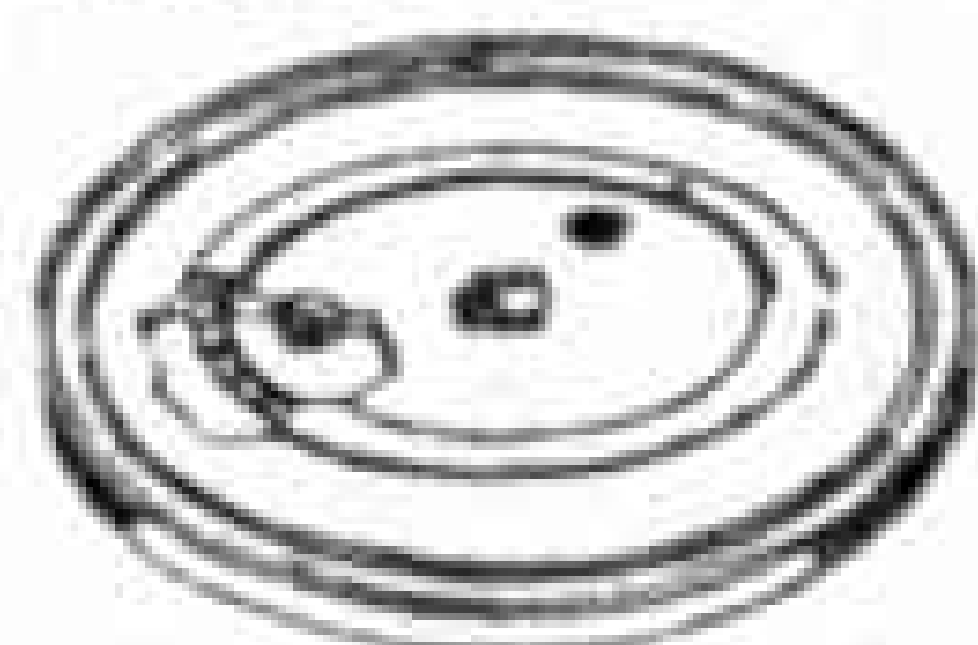


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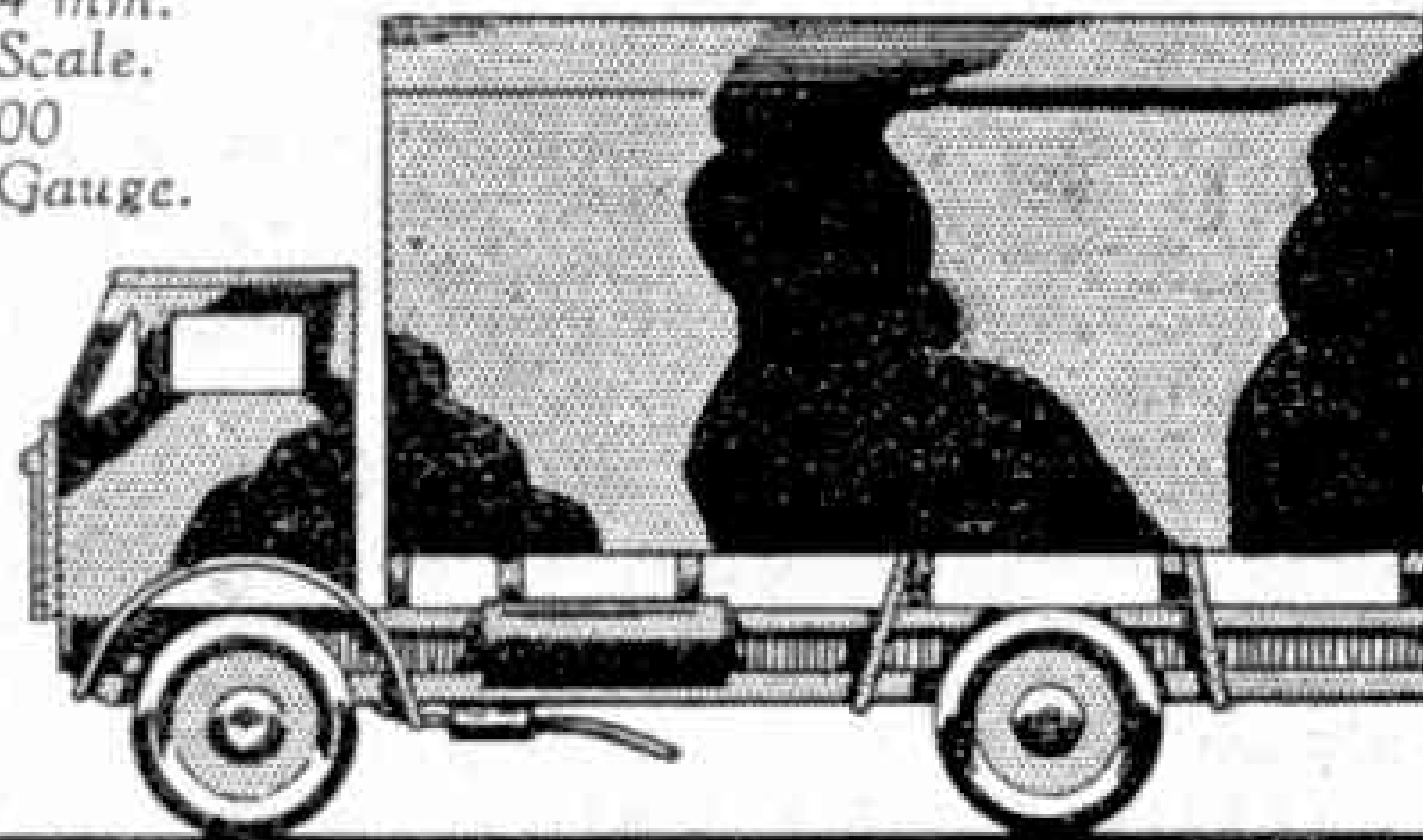
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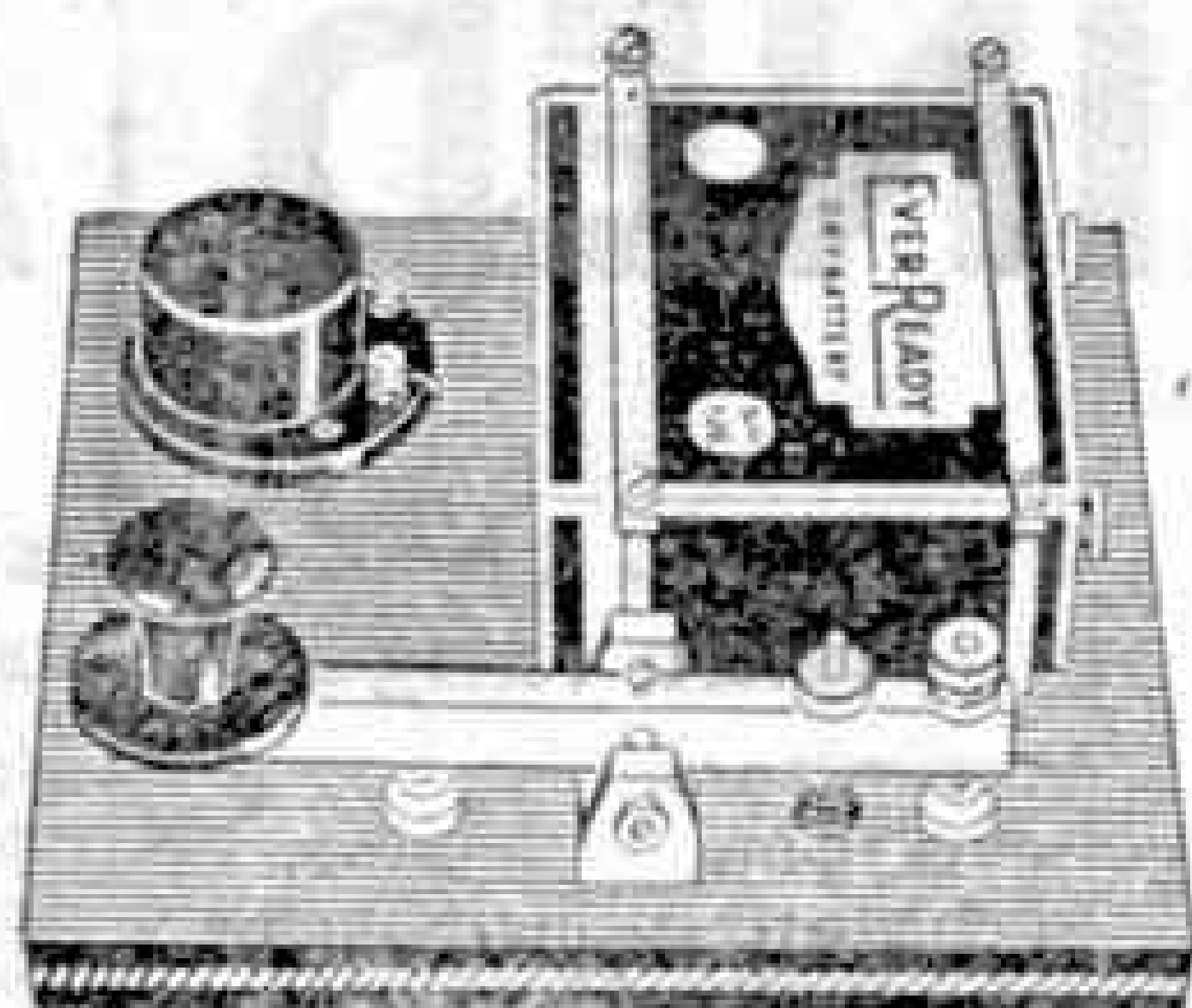
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.22 Webley Senior Air Pistol wanted, in exchange for Diana Air Rifle.—Leman, Haines Hill, Twyford, Berks.

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(See also pages 66 and 68)

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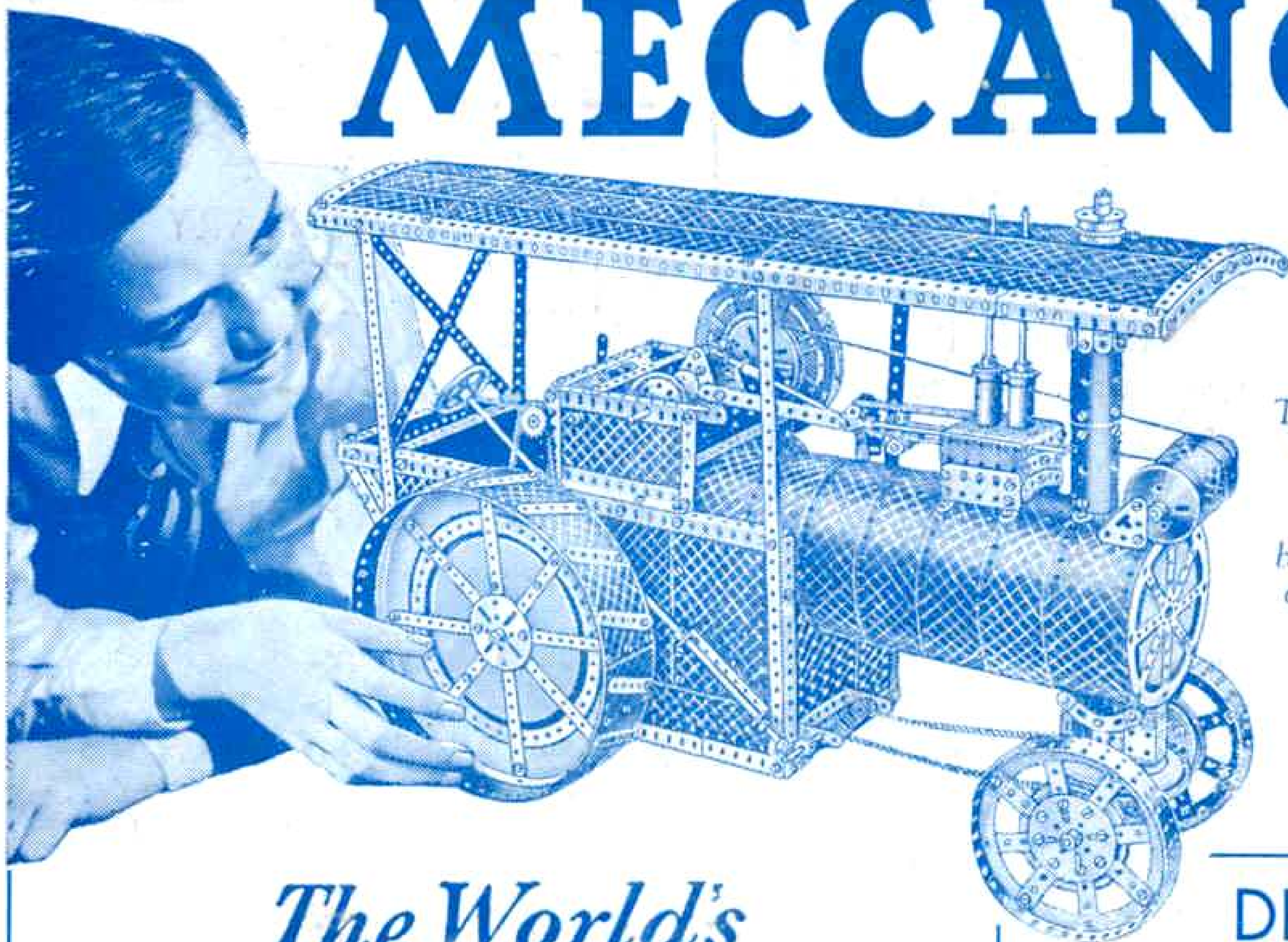
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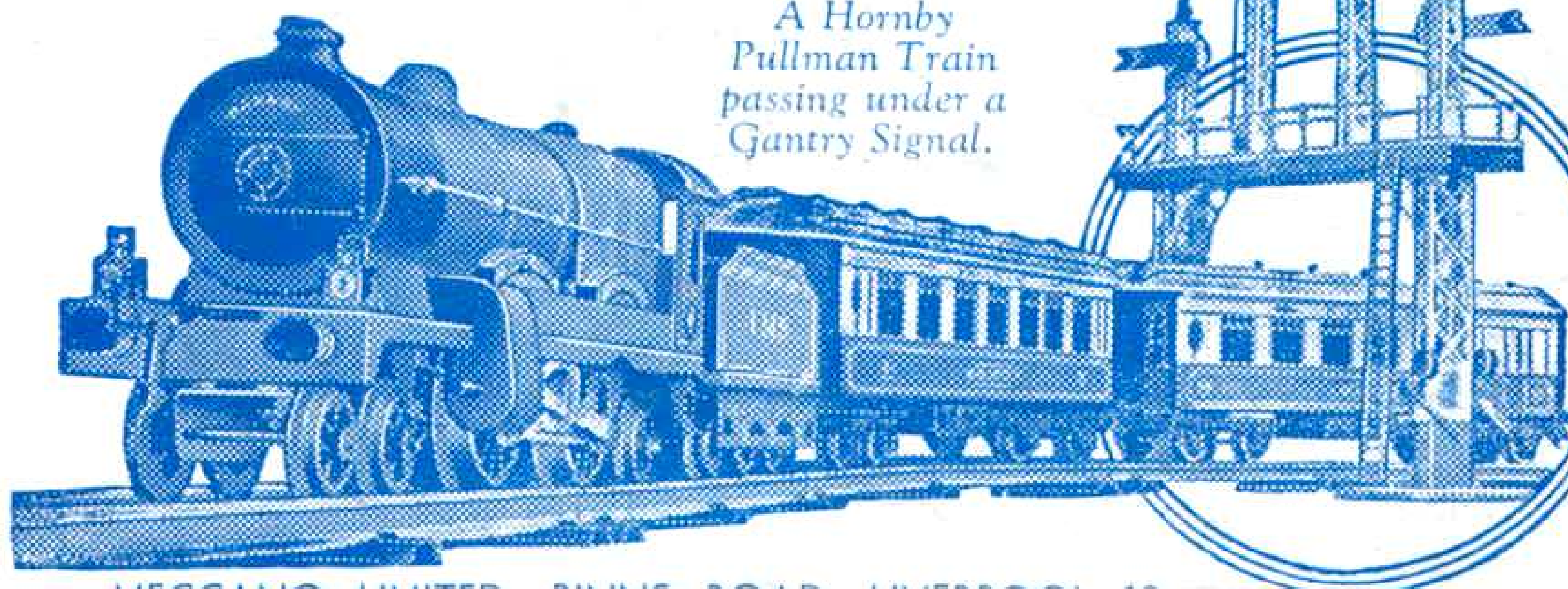


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